

Nuts & Volts

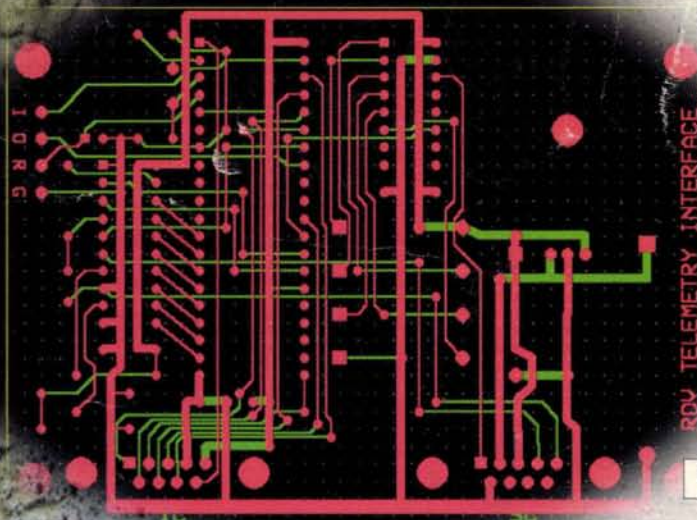
U.S. \$3.50
CANADA \$4.50

Exploring Electronics And Technology For The Hobbyist And Professional

Welcome Robert Nansel —
New Host of Amateur Robotics Notebook!

June 1998 Vol. 19 No. 6

Described by the creators as “a car accident on wheels,” La Machine demonstrated its own version of a “smash fest” at the Robot Wars competition.



Printed Circuit Boards For Everyone!

Thanks to ExpressPCB, prototyping with printed circuit boards can be inexpensive and hassle free.

“To test the promise of ExpressPCB, we decided to re-design a circuit we had previously built using wire-wrap for an unusual hobby project: a home-brew underwater robot.”



CLONE, FORMAT, REPAIR AND TEST ANY DISK DRIVE



STAND ALONE DRIVE DUPE-IT! CLONES ENTIRE DRIVES

Copy entire hard drives with ease. Why spend hours installing and formatting drives when you can do it instantly with Drive Dupe-It! Set up any SCSI or IDE drive with all your original software. Connect blank drives and press start. You'll copy entire drives instantly!

With our combo IDE/SCSI model, you can copy entire hard disk images from IDE to SCSI or vice-versa.

HOT NEW TECHNOLOGY REPAIRS DRIVES

Don't throw those used drives away! Breathe new life into old drives with Dupe-It! Pro. Reassign and eliminate bad SCSI blocks and IDE defects. Put the built-in drive repair system to work for you. Here's how it works: First, a precise analysis system scans the disk surfaces for errors. Defects are then mapped around and effectively "erased". The built-in error correcting system "trains" the drive to permanently avoid defective areas. Your data is stored only on safe areas of the disk. Capacity is reduced by an insignificant amount, and the drive works flawlessly once again.

Get the technology used by major repair shops and modern data recovery centers. Dupe-It! Pro repairs all disk defects caused by normal wear. Drives with excessive mechanical damage may not be repairable.

PRO MODEL INCLUDES FACTORY TEST SYSTEM

Choose the Dupe-It Pro, and you'll also have an entire factory drive test system for under \$1000. The Pro model gives you the ability to copy, reformat, repair, translate, and test any hard disk drive. Use the Pro to put any hard drive through its paces. A full factory final test and performance analysis is performed. Complete test and repair reports are sent to any standard printer.

STAND ALONE IDE DRIVE DUPE-IT
P/N IDI \$395.

COMBO IDE AND SCSI DUPE-IT WITH TRANSLATOR
P/N SDI2 \$795.

PRO MODEL LOADED WITH IDE AND SCSI INTER-
FACES, TRANSLATOR, DRIVE MECHANIC, AND DRIVE
DIAGNOSTIC TEST SOFTWARE WITH PRINTER PORT
P/N SDIPRO \$995.



CORPORATE SYSTEMS CENTER
www.corpsys.com

ORDER FACTORY DIRECT:

408-743-8739

CD DUPE-IT! IS SOLD AND INTENDED FOR BACKUP AND IN-HOUSE
DUPLICATION PURPOSES ONLY. COPYRIGHT LAWS MUST BE
OBSERVED. CALL FOR RACK MOUNT AND MULTI-DRIVE COPIERS.



COPY ANY CD INSTANTLY!

CD DUPE-IT!

Instantly duplicate master CDs for software distribution. Make spare backup copies of your favorite software on rugged, permanent media. Produce custom discs quickly and economically. No mastering or multimedia experience is required.

ONE BUTTON OPERATION. NO PC NEEDED.

Insert your original disc and press "start". The multimedia processor quickly copies any CD to the internal A/V hard drive. Insert blank discs and make as many copies as you like. You'll produce identical, bit-for-bit duplicates. The system is totally self contained — no computer is needed. Just plug it in and press "start". You'll get perfect copies of any CD.

BUILD YOUR OWN CUSTOM AUDIO DISCS!

You can make your own custom audio discs without a PC! Insert your original CDs, select the tracks you want, and copy them. Then insert a blank CD-R, and you'll have a custom audio disc with just the songs you want.

With the included CD mastering software, CD Dupe-It will work overtime. Just attach a SCSI cable to your PC or Mac, and you're ready to design and create your own original CDs.

CD DUPE-IT! \$1095.
CASE OF 100 BLANK DISCS (Green/Gold) \$159.
CASE OF 100 BLANK DISCS (Gold/Gold) \$199.

HSC Electronic Supply

Serving
Silicon Valley
since 1964!

...brings you a potpourri of high-tech goodies for the techno-tinkerer!
For thirty years we have been your source for Silicon Valley exotica!

Ruby Laser Rarity!

- ◆ That's right, be the first on your block to own a Laser Rangefinder module from an M-1 Tank!
- ◆ Optics module from Q-switched Ruby Laser includes cavity, ruby rod (3"), flash tube, spinning prism with high-speed DC motor, half-effect switch, thermistor, etc.
- ◆ Factory refurbished units with spec. / test sheets
- ◆ Does not include power supply or control circuitry
- ◆ Caution...high power bursts -- not for amateurs!
- ◆ Overall measurements 8" long x 2.5" x 1.5" (excl. motor)



HSC#17263

\$65.00

Sound Card Specials!

- Diamond Multimedia Wavetable Sound Card**
- ◆ Multi-interface for CD-ROM (Sony, Mitsumi, Pana., IDE)
 - ◆ Full featured sound capability, 2MB Wavetable, 24 voice
 - ◆ Line-in, Line-out, Mic., Speaker & MIDI/Game jacks
 - ◆ New OEM pack, instruction sheet, 90-day HSC warranty
- HSC#17142 New - Lower Price!! \$17.95**
- Media Vision PCMCIA Sound Card**
- ◆ Great for Portables, Laptops with PCMCIA Slot
 - ◆ External pod has joystick port, mic. input, line in & line out jacks, volume control.
 - ◆ Installation software, instructions included
 - ◆ Windows 3.x, Windows 95 compatible
 - ◆ New in OEM packaging (no box), 90-day HSC warranty
 - ◆ We had these before at \$39.95 and they went fast!
- HSC#17036 \$29.95**

External SCSI Drive Cases

- ◆ Bargain case for 5.25" drives, brand new!
- ◆ 7" x 4.5" x 10.5" overall size
- ◆ 50-pin SCSI connectors
- ◆ SCSI ID switch
- ◆ 65W Power supply (lots of power for hard drives, etc.)
- ◆ Fan-cooled, uses standard IEC Power cord (not included)



HSC# 17130

\$39.95

- ◆ High quality low profile case for 5.25" drives, brand new!
- ◆ 7" x 2.25" x 11" overall size
- ◆ 50-pin SCSI connectors, RCA Audio connectors
- ◆ SCSI ID switch, termination switch
- ◆ Tiny 12W Power Supply (5VDC @ 1.4A, 12VDC @ .4A, probably only good for CD-ROM's)
- ◆ Fan-cooled, uses standard IEC Power cord (not included)



HSC# 17357

\$29.95

- ◆ High quality case for 3.5" drives, brand new!
- ◆ 6.5" x 2.5" x 10" overall size, good for tape drives!
- ◆ 50-pin SCSI connectors, SCSI ID switch
- ◆ Drive bay snaps out for easy access to cables
- ◆ 40W Power Supply (5VDC @ 2A, 12VDC @ 2.5A)
- ◆ Fan-cooled, uses standard IEC Power cord (not included)



HSC# 17356

\$24.95

House that Equipment!

- ◆ Bargain on used, knee high 19" rack cabinets!
- ◆ 29.5" tall, with room for 21" of vertical instrument height
- ◆ 23.25" wide, and 30" front-to-back, textured black finish
- ◆ Made by AMCO Engineering
- ◆ Units are used, but in good shape
- ◆ Best if you pick up (cannot go UPS)
- ◆ Last time we had these at \$149.00, and they went fast! Quantity discounts available.



HSC# 17069

\$99.00

Absolute Last of the Red Hot Reno!

- ◆ Now at clearance price -- Media Vision **Reno**:
- ◆ Consists of new external Reno CD-ROM drive, docking bay with SCSI2 port, AC Adapter, cable kit, travel pouch, headphones
- ◆ Late Model version Uses AC adaptor (included) or AA alkaline batteries (not included)
- ◆ Double-speed 180mS drive is lightning fast!
- ◆ Drive detaches from docking bay, use with headphones as a portable personal audio CD player
- ◆ Great for Mac or IBM (adaptor bracket included)
- ◆ SCSI Controller & software required for IBM use
- ◆ Brand new, 90-day warranty



Available Separately:

A. Macintosh Powerbook SCSI Adapter (HDI-30 to 25-pin D connector) **HSC#15704 \$12.50** if purchased alone, or with purchase of Reno Kit, \$5.00

Super Sounding Speakers!

Tired of the cheesy sound coming from those give-away speakers in your multimedia kit? Try upgrading to these sonic wonders...you'll have to hear them to appreciate the difference these will make without blowing your budget!

GNT2500 2-way Bass-Reflex speakers

- ◆ 3.5" woofer, 1" piezo tweeter
- ◆ 15W built-in amplifiers, 80W peak, 5.4W RMS
- ◆ 40 - 20,000 Hz, built-in SRS 3-D stereo
- ◆ Measure approx. 3.75" x 6.125" x 9.25" tall
- ◆ AC adaptor, audio cables included
- ◆ On-off switch, 3-D switch, tone & volume controls
- ◆ Attractive off-white finish with grey grille-cloth



HSC#16670

\$29.95

GNT3000 3-way Bass-Reflex speakers

- ◆ 4" woofer, 2" midrange, 1" piezo tweeter
- ◆ 23W built-in amplifiers, 120W peak, 20W RMS
- ◆ 20 - 20,000 Hz, similar to GNT3500, but no SRS 3-D
- ◆ Measure approx. 6.25" x 6.5" x 9.75" tall
- ◆ AC adaptor, audio cables included
- ◆ On-off switch, bass, treble & volume controls
- ◆ Attractive off-white finish with grey grille-cloth



HSC#17085

\$39.95

X-Windows Terminal!

- ◆ Tiny Axil/Hyundai X/11C smart terminal has big features!
- ◆ Connect to Ethernet (Coax or AUI), SLIP, or both!
- ◆ Built-in 10Base2 transceiver, 10Base5 AUI interface
- ◆ Uses a variety of protocols, TCP/IP, SLIP, TELNET, RARP, BOOTP, XDMCP, or PPP
- ◆ Comprehensive self-test and help menus for setup
- ◆ Requires 63.775KHz Horizontal, 67.9Hz Vertical (workstation-type) monitor, resolution is 1152 x 900
- ◆ RAM can be upgraded to 16MB (4MB SIMM included)
- ◆ New in box, includes 101-key keyboard, mouse, manual
- ◆ Measures 11.5" x 11" x 2", keyboard is 18" x 7"



HSC#17213

\$149.95

Infrared Connections!

- ◆ IBM "Options" series ISA-Bus and PCMCIA card adaptors will add industry standard infrared communications capability to your desktop PC (with ISA slots) or notebook computer! (Win95 instructions available on our website)
- ◆ Allows wireless connection to compatible notebooks, workstations, printers, and other peripherals supporting the Infrared Data Association (IrDA) standard.
- ◆ Also will emulate a COM port for cable-less hook-ups
- ◆ Communicates up to 115Kbps, or up to 1.152Mbps with the included TranXit Software.
- ◆ Operates over distances up to 3 meters (10 ft.)
- ◆ Includes Card, transceiver module, driver disk & book
- ◆ Both styles new in box, 90-day warranty



HSC#16483 PCMCIA Version

\$19.95

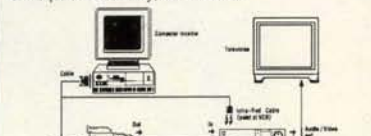
HSC#16813 ISA-Bus Version

\$19.95

Or a package deal...get both for \$29.95

PC Videotape Editor!

- ◆ Use your computer to edit your home videos!
- ◆ Delete footage, rearrange up to 99 scenes automatically!
- ◆ No expensive computer cards to install!
- ◆ Requires 386 or higher computer, Sony-type Control-L (LANC) source camcorder and a recording VCR with infra-red remote control with TV or video monitor.
- ◆ Unit consists of a cable to control the playback of your camcorder, and an infra-red transmitter to control VCR
- ◆ Plugs into parallel port of your computer -- no disassembly of your computer required!
- ◆ Includes software (Win3.1 compatible) cables and manual
- ◆ New in box - 90 day warranty
- ◆ Requires 9V battery, not included



HSC#17154

\$29.95

Little Pump That Could!

- ◆ Tiny Gast Vacuum/Pressure diaphragm pump
- ◆ Model MOA-V112-AE -- oil-less design means clean air!
- ◆ Measures 7" long, 3.375" dia., 4.75" tall
- ◆ 115 VAC, new in box with installation & parts diagram



HSC#17360

\$74.95

PCMCIA GPS Card

- Trimble Mobile GPS Gold Card**
- ◆ Turn your notebook into a GPS locator!
 - ◆ Receiver is PCMCIA Type I card
 - ◆ Includes roof or panel-mount antenna with 15' cable
 - ◆ Trimble Mobile GPS software & instructions included
 - ◆ Software gives coordinates, not maps
 - ◆ New, OEM pack, 90-day warranty

\$149.00

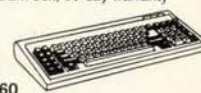
Briefcase of Goodies!



- ◆ These handsome hardshell cases were used to carry a laptop-computer estimating system (laptop not included)
 - ◆ They were used with a Compaq LTE laptop, and provided a SCSI port for a CD-ROM drive with battery back-up
 - ◆ Large Nicad pack has 10 D-size Sanyo Cadnics cells.
 - ◆ Built-in 19VDC power supply for battery charging
 - ◆ Tiny piggy-back PC board seems to be a SCSI interface
 - ◆ Case measures 18" x 14" x 7", with several compartments
 - ◆ SCSI II to CEN50 SCSI cable, many great parts inside!
 - ◆ Buy either the whole assembly, or just the parts you want!
 - ◆ Not guaranteed to function with laptops -- for parts only!
- HSC#17180 Complete Laptop Case \$49.95**
- HSC#17182 Empty Hardshell Case \$29.95**
- HSC#17181 Nicad Pack, 12.5VDC, 5AH \$17.50**
- HSC#17179 SCSI II Cable, 1 ft. long \$12.50**

Parallel-Port Keyboard!

- ◆ Perfect for notebook computers, laptops, palm-tops, etc.
- ◆ Full-size 101 keyboard by ALPS, model LPT 101
- ◆ Includes manual, installation diskette
- ◆ New in OEM box, 90-day warranty



HSC#17160

\$49.95

Rugged Mike & Speaker!

- ◆ Extra-heavy duty hand-held microphone & enclosed speaker for extreme environmental use
- ◆ Made by GE for Ericsson EDACS "Orion" mobile radios
- ◆ Easily modifiable for your own use (ham, CB, etc.)
- ◆ Brand new in box, with custom Ericsson power cable



HSC#17172

\$29.95

Extra-long Cord Outlets!

- ◆ Don't daisy-chain those outlet strips to get power where you need it! (The fire department doesn't approve!)
 - ◆ Multi-outlet SG/Waber outlet strips have extra-long cords
 - ◆ UL Approved, metal housings, 15 Amp circuit breaker
 - ◆ Brand new, two lengths to choose from!
 - ◆ Hurry, these won't last long, especially the 50-footers!
- HSC#17172 4-Outlet strip w/ 15' cord \$9.95**
- HSC#94148 3-Outlet strip w/ 50' cord \$17.50**

Quick, Cheap, Easy IDE!

- ◆ What more could you want in an IDE controller?
- ◆ Creative Technology CT1871 Plug and Play card
- ◆ Perfect for CD-ROM's, other non-bootable SCSI devices
- ◆ 16 bit short ISA card has minimum parts count
- ◆ Supports up to two CD-ROM drives
- ◆ All settings are PnP settable, supports all ATAPI drives
- ◆ New, OEM bag with spec. sheet, 90-day warranty

HSC#17358

\$3.95

Halted specialties co. HSC Electronic Supply

Toll Free (Orders Only) 1-800-4 HALTED
Internet World Wide Web:
3500 Ryder St., Santa Clara, CA 95051
4837 Amber Ln., Sacramento, CA 95841
5681 Redwood Dr., Rohnert Park, CA 94928

(1-800-442-5833)
<http://www.halted.com>
(408) 732-1573
(916) 338-2545
(707) 585-7344

FAX your orders to:
(408) 732-6428



Visit HSC's Website!

- ◆ Pay us a virtual visit on the World Wide Web!
- ◆ Simply point your browser to <http://www.halted.com>
- ◆ Site is constantly being revised, please visit often!
- ◆ Check out the amazing "Gizmo of the Week" feature!

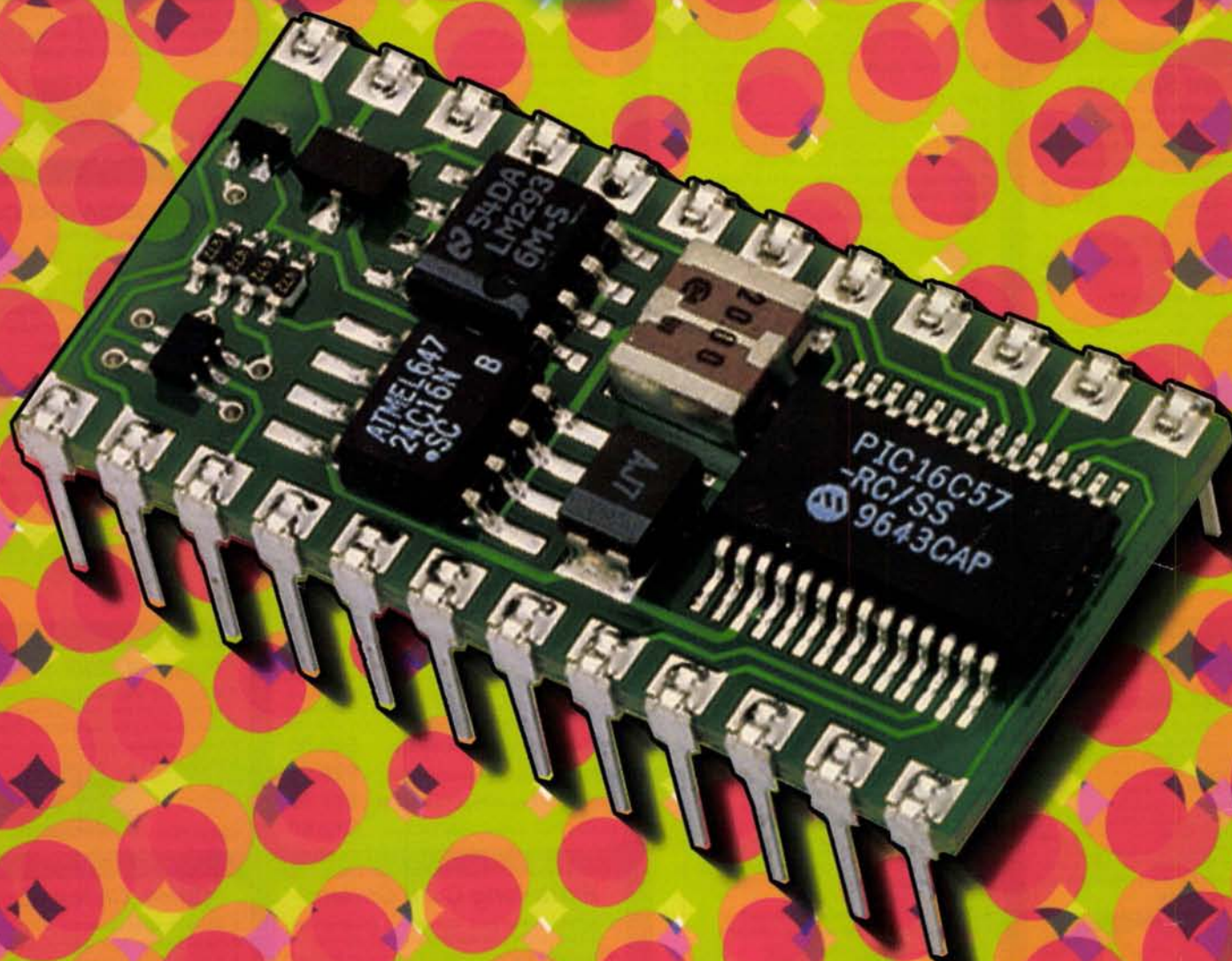
HSC Catalog online!

- ◆ That's right, get HSC's catalog on the World-Wide Web!
- ◆ Simply go to www.halted.com and follow the big red link.
- ◆ Adobe .PDF files are available for download and viewing.
- ◆ Or drop on by and pick one up...we'd love to see you!

Terms: Some quantities limited; all items subject to prior sale. Minimum order: \$10.00 plus shipping. Orders under \$20.00 subject to \$2.00 handling fee, in addition to shipping. All orders shipped FOB Santa Clara, CA (this means you pay freight!) by UPS Surface (no P.O. Boxes) unless otherwise specified, in which case prevailing carrier rate plus \$5.00 handling fee applies. Prepaid orders that don't include shipping charges will be shipped freight COD. There is a \$4.75 UPS charge added to shipping charges for COD shipments. If you have questions about your order, please call Customer Service at (408) 732-1854 M-F 9AM to 5PM PST.

***Most people dance
when they***

FREQOUT

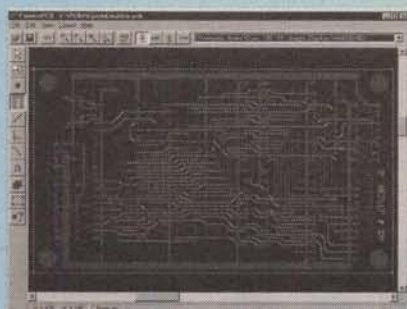


***...but BASIC Stamps[®]
generate sine waves***

PARALLAX 

<http://www.parallaxinc.com>
916.624.8333

BASIC Stamp and the Parallax logo are
registered trademarks of Parallax, Inc.



Engineering Express has recently unveiled its new ExpressPCB layout software and ExpressPCB manufacturing service for fast turnaround/low-cost printed circuit boards. Together they provide an integrated solution for professionally prototyping electronics very quickly and economically.

The ExpressPCB layout editor is available for Windows95 and WindowsNT. The strength of the layout package comes from its intuitive design and ease of use. The standard Windows user interface makes it simple to master PC board design in a single evening. The editor includes a large library of stock components, many components reference the manufacturer's part numbers. The software is available at no cost and can be downloaded from www.expresspcb.com

To complement the layout editor, Engineering Express has an integrated PC board fabrication service that manufactures very high-quality, double-sided printed circuit boards with plated-through holes. This integrated solution allows the user to instantly get quotes for PC boards, and place orders directly from the layout program. Once an order is placed, the software automatically transmits the layout over the Internet to the ExpressPCB manufacturing service.

For more information, contact:

ENGINEERING EXPRESS
56 CONCORD AVE., #33
DEPT. NV
CAMBRIDGE, MA 02138
617-441-9497
E-MAIL:
reifelp@expresspcb.com

CDT-4



Anon-invasive tester (CDT-4) for ACD players, DVD, Laser disc players, CD-ROMs, computers, preamplifiers, amplifiers, tuners, DATs, VCRs, and tape decks is introduced by SoundSmith.

The CDT-4 tests for intermittent signal level change, CD skips, noise distortion, or loss of signal.

New Product

Our readers are always looking for new and interesting electronic items. Showcase your NEW PRODUCTS here to help stimulate your product's success. Submit all news releases, product information, and/or photos to:

NUTS & VOLTS MAGAZINE
NEW PRODUCT EDITOR
430 PRINCELAND CT., CORONA, CA 91719

News

Errors are logged for up to five days or more in non-volatile memory and are displayed on large numeric LEDs. Error information can also be fed via an RS232 port to a computer or printer for complete error printout.

The CDT-4 comes with a specially designed audio CD, and may be used for automated integrity testing of any analog signal path. It runs on either the supplied 13-volt AC transformer, or on 12 volts DC for automotive stereo testing.

Users for the tester include audio servicers, custom home installers, audio retailers, engineers, and service personnel in the radio and television broadcast industries, computer sales and service people, audio manufacturers, and automotive stereo dealers and servicers.

The CDT-4 features a multi-segmented display on the front of the instrument to indicate the number of tests, and number and type of failures, and when during the testing they occurred. A computer interface is provided to allow the user to view, store, or create a print-out of the results. This information is invaluable in allowing the technician to pinpoint the nature of the problem, and to then effectively solve the problem.

Model CDT-4 is available for \$749.00 (includes power supply, test CD, and manual). Replacement CDs are \$29.95.

For more information, contact:

SOUND SMITH
8 JOHN WALSH BLVD.
STE. 417 DEPT. NV
PEEKSKILL, NY 10566
1-800-942-8009
914-739-2885
FAX: 914-739-5204
WEB: www.sound-smith.com

PAGEPRO



RF Neulink announces PagePro, its new line of synthesized digital paging transmitters with built-in POCSAG paging encoder.

PagePro comes with paging software that runs in a Windows 95 or Windows NT environment. Generating numeric, alphanumeric, and tone pages is as easy as a mouse click.

Although designed to handle the demands of wide area paging, the PagePro is equally well-suited for in-house and local area paging.

The PagePro series is fully synthesized and can be easily field programmed in 10 or 12.5 KHz increments via a built-in RS 232 port.

Several models are available covering the 134-174 MHz, 218-230 MHz, and 260-280 MHz ranges.

Output power is adjustable with a nominal maximum output of five watts in the 136-174 MHz range and two watts in the 218-230 MHz and 260-280 MHz ranges.

For more information, contact:

RF NEULINK
7610 MIRAMAR RD., DEPT. NV
SAN DIEGO, CA 92126
619-549-6340
FAX: 619-549-6345
1-800-233-1728
rfneulink@rfindustries.com

NAVIFINDER-200™



Precision Navigation, Inc. introduces the Navifinder-200™ electronic compass module, which is ideal for use in RVs, snowmobiles, motorcycles, boats, and van/truck conversions. It can easily be mounted in a dash or enclosed in a housing.

The Navifinder-200 uses advanced calibration algorithms that discriminate between the earth's magnetic field and those generated externally, such as from the metal and electronics in a vehicle. By electronically compensating for these external factors, the Navifinder-200 is able to provide highly accurate compass readings in all vehicle environments.

The Navifinder-200 is much easier to set-up than a floating ball compass, taking less than two minutes to calibrate. Plus it is simpler to use because it continuously displays your exact heading, eliminating the guesswork involved in reading an unstable floating ball, which is necessary with most other vehicle compasses.

The Navifinder-200 compass is priced at \$75.00 in single units for the avid hobbyist and, for OEMs, the 1,000 unit price drops to \$32.00.

For more information, contact:

PRECISION NAVIGATION, INC.
1235 PEAR AVE., STE. 111
DEPT. NV
MOUNTAIN VIEW, CA 94043
650-962-8777 FAX: 650-962-8776
E-MAIL:
sales@precisionnav.com
WEB: www.precisionnav.com

NEW FM LOW-PASS FILTERS



Progressive Concepts announces three new low-pass filters Model LPF7000, LPF7002, and LPF7003.

These highly efficient Chebyshev design filters have a bandpass of 0-108 MHz and offer up to 75 dB of attenuation to harmonic energy in the range of 120-500 MHz. With an insertion loss of less than .01 dB, these filters are well-suited for use on power levels as low as 100 milliwatts on up to 300 watts. Input and output impedances are both 50 ohms and they are available with SO-239 or "N" type connectors.

Prices start at \$69.00.

For more information, contact:

PROGRESSIVE CONCEPTS
P.O. BOX 586, DEPT. NV
STREAMWOOD, IL 60107
630-736-9822
FAX: 630-736-0353

Continued on page 13



Volume 19 No. 6 • JUNE 1998

Contents

ON THE COVER ... PCBs and ROBOTS, ROBOTS, ROBOTS ...

ARTICLES

FREE RADIO SIGNALS FOR GPS ERROR CORRECTION Gordon West.....8

Right now, the US Coast Guard and the Department of Transportation are providing GPS users with free correction signals.

SECURITY ELECTRONICS SYSTEMS AND CIRCUITS — PART 5 Ray Marston28

Take a look at IR light-beam and PIR movement-detector circuits and systems in this month's installment.

THE WEEKEND WORKBENCH Andy A. Node.....82

Andy returns with an IR switch that lets you control your lights with your VCR remote.

C POINTERS AND LINKED LISTS Jeff Stefan87

This article will help you understand pointers, and provides linked list code that you can use in your own applications.

PRINTED CIRCUIT BOARDS FOR EVERYONE David Schneider & Stanley Reifel95

Thanks to ExpressPCB, prototyping with printed circuit boards can be inexpensive and hassle-free.

ROBOT WARS 1997: LA MACHINE Dan Danknick.....99

Described by the creators as "a car accident on wheels," La Machine demonstrated its own version of a "smash fest" at the Robot Wars competition.

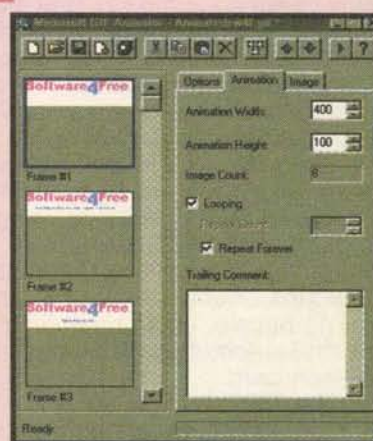


DEPARTMENTS

ADVERTISER'S INDEX	92
CLASSIFIED AD INFO	92
DEALER DIRECTORY	71
EVENTS CALENDAR	20
NEW PRODUCT NEWS	5
NV ADMART	76-77
ELECTRONICS Q & A	66
READER FEEDBACK	13
TECH FORUM	36

EDITORIAL CONTRIBUTIONS

Nuts & Volts Magazine encourages article submissions and queries. Send a SASE for a copy of our writer's guidelines. All submissions should be on 5-1/4 or 3-1/2 inch diskettes and include hard copy as well. If return of materials is requested, include a SASE with your submission. Deadlines should be discussed in advance with the editor, but generally all material should be submitted two weeks prior to the 1st of the month for the next month's issue.



COLUMNS

AMATEUR ROBOTICS NOTEBOOK Robert Nansel72

Our new host starts with a simple, easily customizable project: the Breadbot.

OPEN CHANNEL Joseph J. Carr K4IPV16

Some practical matters: troubleshooting, op-amps, and PCB software.

RESOURCE BIN Don Lancaster78

A look at accessing offshore electronics.

SOFTWARE WIZARDRY Harry Helms.....100

Getting animated with your graphics

STAMP APPLICATIONS Jon Williams23

Talk is cheap. Give your BASIC Stamp projects a voice with the SP0256-AL2 allophone speech processor from General Instruments.

CLASSIFIED AD INDEX

10. Ham Gear for Sale.....	41	125. Microcontrollers	55
20. Ham Gear Wanted	41	130. Antique Electronics	55
30. CB/Scanners	41	135. Aviation Electronics	65
40. Music & Accessories	41	140. Publications	56
50. Computer Hardware	41	145. Robotics	56
60. Computer Software	43	150. Plans/Kits/Schematics.....	57
70. Computer Equip. Wanted	44	155. Manuals/Schematics	
80. Test Equipment.....	44	Wanted	58
85. Security	48	160. Misc. Electronics For Sale.....	58
90. Satellite Equipment	49	170. Misc. Electronics Wanted.....	59
95. Military Surplus Electronics	49	175. BBS & Online Services	60
100. Audio/Video/Laser	49	180. Education	60
110. Cable TV	50	190. Business Opportunities.....	60
115. Telephone/Fax	54	200. Repairs/Services	61
120. Components.....	54		

Nuts & Volts Magazine is published monthly for \$19.00 per year by T&L Publications, Inc., 430 Princeland Court, Corona, CA. POSTMASTER: Send address changes to Nuts & Volts Magazine, 430 Princeland Court, Corona, CA 91719.

Published Monthly By
**T & L Publications,
Inc.**

430 Princland Court
Corona, CA 91719
(909) 371-8497
FAX (909) 371-3052

E-Mail

editor@nutsvolts.com

URL

http://www.nutsvolts.com

**Subscription
Order ONLY Line
1-800-783-4624**

Publisher

Jack Lemieux N6ZTD

Editor

Larry Lemieux KD6UWV

Managing Editor

Robin Nelson KD6UWS

**On-The-Road Exhibit
Coordinator**

Audrey Lemieux N6VXW

Subscriptions

Abby Madain

Classified Ads

Natalie Sigafus

Copyright 1998

by **T & L Publications,
Inc.**

All Rights Reserved

All advertising is subject to publisher's approval. We are not responsible for mistakes, misprints or typographical errors. Nuts & Volts Magazine assumes no responsibility for the availability or condition of advertised items or for the honesty of the advertiser. The publisher makes no claims for the legality of any item advertised in Nuts & Volts. This is the sole responsibility of the advertiser. Advertisers and their agencies agree to indemnify and protect the publisher from any and all claims, action or expense arising from advertising placed in Nuts & Volts. Please send all subscription orders, correspondence, UPS, overnight mail and artwork to: 430 Princland Court, Corona, CA 91719.

The closing date for each issue is the 5th of the prior month, e.g., the closing date for the June issue is May 5th. Ad copy to be typeset by Nuts & Volts should be received one week prior to the closing date. Call or write for current advertising rates.

CHANGE OF ADDRESS

If you are moving, notify us AS SOON AS POSSIBLE so we can continue your subscription without interruption.

Your magazine **WILL NOT** automatically be forwarded to you by the post office, so it's important to submit your change of address directly to Nuts & Volts. We will not be able to replace missed issues of the magazine due to unreported address changes.

When you send in your new address, include a current mailing label from the magazine with your account number on it. If you do not have a mailing label, be sure to include your old address and the name(s) under which the subscription was submitted.

**DON'T MISS
A SINGLE
ISSUE!!
SUBSCRIBE
TODAY!!**

To Subscribe to NUTS & VOLTS

USA ONLY

\$19.00 — One Year

\$35.00 — Two Years

MAILED FIRST CLASS — FOREIGN ONLY

\$37.00 — Canada/Mexico

\$100.00 — Foreign/Air Mail

\$50.00 — Foreign/Surface

Send payment to the address below or call 1-800-783-4624 and use your Visa or MasterCard.

Nuts & Volts Magazine, 430 Princland Court, Corona, CA 91719

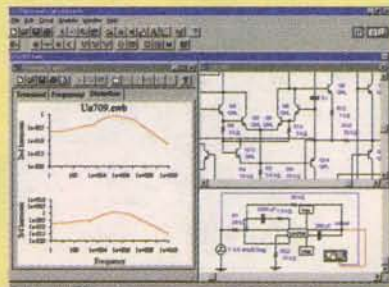
Better Designs - Faster With the Personal Design Solution

The Design Solution Includes: Electronics Workbench Personal Edition + EWB Layout

**Electronics
Workbench**
Personal Edition

Full-featured schematic capture and SPICE 3F circuit simulation!

The world's best selling circuit design software. With analog, digital and mixed A/D SPICE simulation, a full suite of analyses and over 4000 devices. Imports netlists. Seamlessly integrated with EWB Layout or exports to other popular PCB programs. Still the standard for power and ease of use. Still the same effective price.



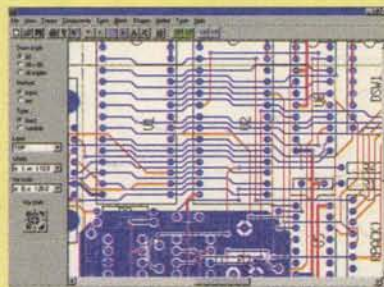
HIGH-END FEATURES

TRUE MIXED ANALOG/DIGITAL	YES
FULLY INTERACTIVE SIMULATION	YES
PRO SCHEMATIC EDITOR	YES
HIERARCHICAL CIRCUITS	YES
VIRTUAL INSTRUMENTS	YES
ON-SCREEN GRAPHS	YES
ANALOG AND DIGITAL MODELS	OVER 4,000
FREE TECHNICAL SUPPORT	YES
DC OPERATING POINT	YES
AC FREQUENCY	YES
TRANSIENT	YES
FOURIER	YES
NOISE	YES
DISTORTION	YES

**Electronics
Workbench** *Personal Edition* **Layout**

Power-packed PCB layout with autorouting and real-time DRC!

EWB Layout is a powerful board layout package for producing high-quality, multi-layer printed circuit boards. Offering tight integration with our schematic capture program, you can incorporate board layout and design and quickly bring well-designed boards to production.



POWER-PACKED FEATURES

AUTOROUTING	YES
REROUTE WHILE MOVE	YES
LAYERS	32 ROUTING LAYERS
BOARD SIZE	50" X 50"
LIBRARY SHAPES	OVER 3,500
BLIND AND BURIED VIAS	YES
EXTENSIVE OUTPUT	YES
SELECTIVE NET HIGHLIGHTING	YES
USER DEFINED PADS	YES
REAL TIME DESIGN RULE CHECK	YES
DENSITY HISTOGRAMS	YES
FREE TECHNICAL SUPPORT	YES

\$299
Version 5

\$299
Version 5

**30-DAY MONEY-BACK
GUARANTEE**

*Join over 85,000 customers
and find out why more circuit designers
buy Electronics Workbench than
any other circuit design tool.*

**CALL FOR INFORMATION
AND PRICING ON OUR
PROFESSIONAL EDITION.**

ELECTRONICS WORKBENCH Personal Edition \$299.00
EWB LAYOUT Personal Edition \$299.00

**BUY
BOTH
AND
SAVE**

PERSONAL DESIGN SOLUTION \$598.00
\$548.00

CALL 800-263-5552

**For a free demo, visit our website
at http://www.interactiv.com**

INTERACTIVE IMAGE TECHNOLOGIES LTD., 908 Niagara Falls Boulevard,
#068, North Tonawanda, New York 14120-2060 / Telephone 416-977-5550.
TRADEMARKS ARE PROPERTY OF THEIR RESPECTIVE HOLDERS. OFFER IS IN U.S. DOLLARS AND VALID ONLY
IN THE UNITED STATES AND CANADA. ALL ORDERS SUBJECT TO \$15 SHIPPING AND HANDLING CHARGE.
Fax: 416-977-1818 E-mail: ewb@interactiv.com
CompuServe: 71333,3435 / BBS: 416-977-3540



FREE RADIO SIGNALS FOR GPS ERROR CORRECTION

You may have thought that the old boater's beacon band from 200 KHz-500 KHz has been abandoned. Not so! The United States Coast Guard, plus the Department of Transportation for highway and railroad positioning, will provide us free low-frequency correction signals for sub-meter accuracy ...

The Department of Defense global positioning system has achieved such widespread positive response in its capabilities that almost everyone, every single day, benefits from it.

Boaters navigate with GPS. Pilots stay on track. Backpackers can carry a \$99.00 Magellan Pioneer GPS to safely guide them back down the trail. Paramedics and police keep track of their response vehicles with GPS. Surveyors use GPS for centimeter and millimeter accurate benchmarks.

The flower delivery you received this morning was guided by GPS to your doorstep. Pizza Man is tracked on GPS to keep your cheese and anchovies piping hot as they direct him to the next stop.

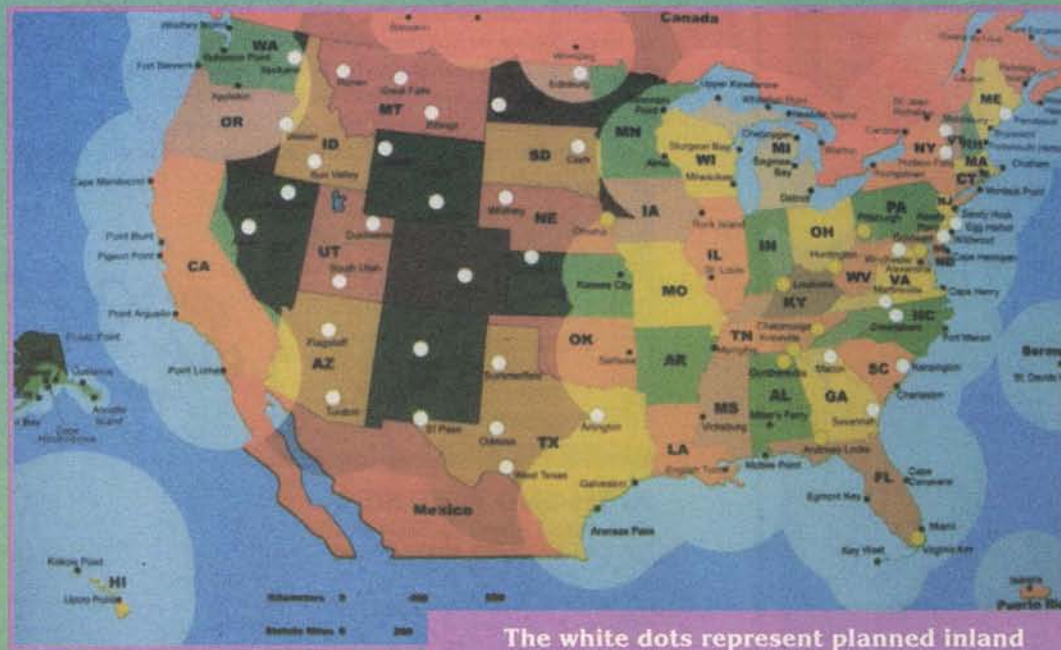
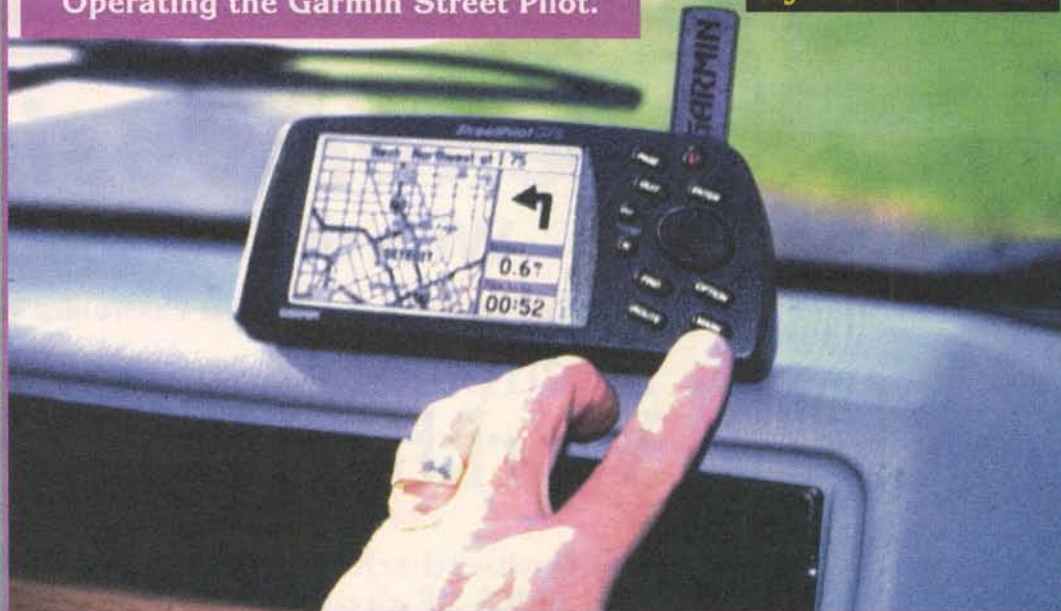
Many high-end vehicle manufacturers may offer global positioning system car-navigation systems as an option. Hertz Corporation — the world's largest car rental company — has expanded the availability of its "NeverLost" navigation system, manufactured by Magellan, to more than 50 rental locations in 35 US cities, equipping 8,000 rental vehicles.

"Businessmen depend on the global positioning system to voice-instruct them exactly how to get to their client's location in a strange city," comments Jim White of Magellan. "Travelers can also find it extremely useful for navigating their way around unfamiliar towns and finding hotels, restaurants, and points of interest," adds White. Consumers can buy this system as "PathMaster" for a retail price of \$1,995.00, and this includes one regional data base cartridge and the installation of that cartridge in their set-up.

There is also the cellular phone GPS system from Bartizan Communications, nicknamed "Bart," that does not necessarily have the big

Operating the Garmin Street Pilot.

by Gordon West



The white dots represent planned inland DGPS beacon stations.

Equipment Management Technology

From Acquisition to Disposition

BUY * RENT * SELL
Quality
Test and Measurement Equipment

We inventory HP, Tektronix, Fluke, Anritsu, Wiltron, Iwatsu, Wavetek, GenRad and many other manufacturers. Our product lines include RF & microwave, oscilloscopes, generators, supplies, communications, voltage and frequency standards. Call us now for a quote!

Tel 650-631-1700 * Fax 650-631-1200 * email sales@emt1.com

PARTS - PARTS - PARTS

65.8 Mhz Saw Filters	100 pcs. - \$2.40@	300 pcs. - \$2.00@	600 pcs. - \$1.75@
16 & 18 Pin IC Sockets	500 pcs. - \$.09@	1,000 pcs. - \$.07@	5,000 pcs. - \$.05@
18VAC, 300mA, Wall Transformers (Perfect for Stealth Units)	50 pcs. - \$3.00@	100 pcs. - \$2.50@	250 pcs. - \$2.00@
4 Mhz Resonators, 3 pins			
4 & 8 Mhz Crystals, 2 pins	100 pcs. - \$.45@	500 pcs. - \$.40@	1,000 pcs. - \$.35@
24 Mhz Crystals, 2 pins	100 pcs. - \$.55@	500 pcs. - \$.50@	1,000 pcs. - \$.44@
Micro-Chip Pic-16C54RC	100 pcs. - \$2.10@	250 pcs. - \$1.95@	500 pcs. - \$1.85@
Micro-Chip Pic-16C56RC	100 pcs. - \$2.30@	250 pcs. - \$2.25@	500 pcs. - \$2.15@
TDA-8340 I.C.	100 pcs. - \$2.00@	500 pcs. - \$1.75@	1,000 pcs. - \$1.68@
TSA-6060 I.C.	100 pcs. - \$3.48@	500 pcs. - \$2.75@	1,000 pcs. - \$2.45@

Call for Larger Quantity Quotes

Phone: (515) 847-3888

Fax: (515) 847-3889

BBS: (515) 847-3890

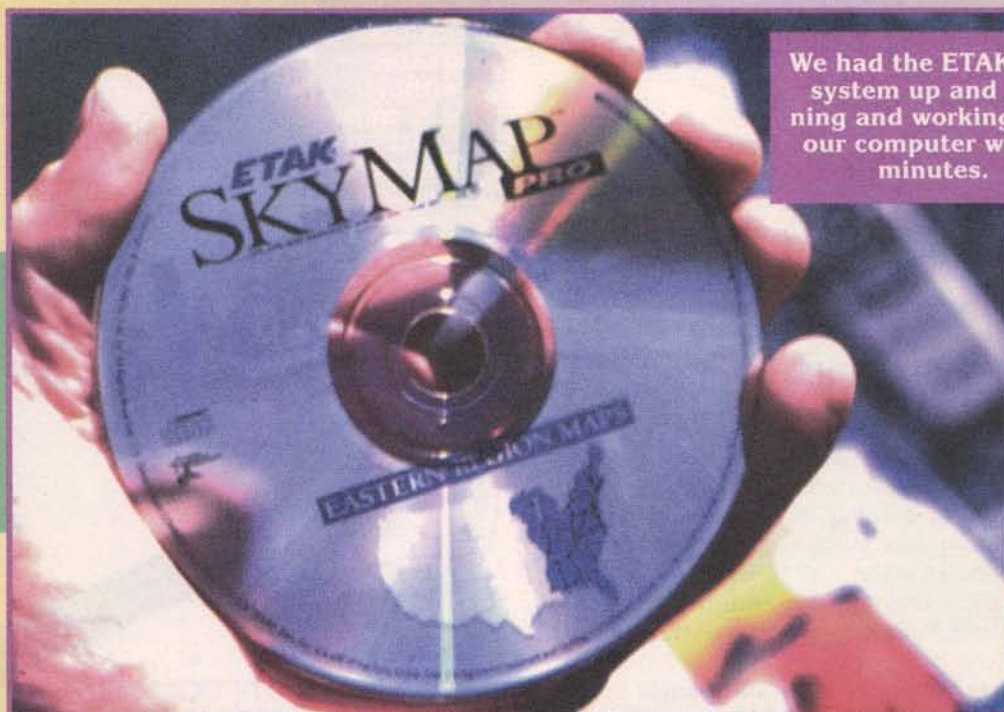
CAPITAL
ELECTRONICS INC.

303 Sherman Street
Ackley, Iowa 50601

E-Mail: sales@capital-elec.com
Web: http://www.capital-elec.com

WE ACCEPT





We had the ETAK GPS system up and running and working with our computer within minutes.

street map on the dash, but constantly keeps track of your whereabouts out on the highways and byways, and allows for instant contact to a dispatcher who can send help or the medics to the position they see on their screen via cellular.

There is also the BEACON from EX2 Company (1-800-392-7686) that offers a color touch-screen readout of every street, highway, one-way road, and alley in the United States, Canada, and Alaska. "There is even a wireless infrared keyboard that may allow this system to do double-duty as an office work station," comments Wayne Bagrowsky at EX2. "We also have the professional car-navigation capabilities of voice prompts that will tell the driver when to turn left, go back, or hang a right," adds EX2.

BUT HOW ACCURATE?

The global positioning system transmits two signals for "precise" positioning — Channel L1 is a spread-spectrum signal on a carrier frequency of 1575.42 MHz, and Channel L2 — reserved for authorized users only — transmits on

1227.60 MHz spread-spectrum.

Civilian equipment like the \$99.00 Magellan, or the \$350.00 Garmin GPS III mapping system, or the \$2,000-\$4,000 GPS chart and mapping systems, receive only the L1 channel leading to a 95 percent probability of position accuracy within the radius of a 300-foot circle.

RADIUS

This means a potential error out to 300 feet

from your position in the center of a circle. This means you could mark a favorite scuba dive spot in error 295 feet due north, and then try to return to that same spot a few days later in error 295 feet south. This could put you two football fields away from the earlier position, and one football field away from where you actually are.

Hey, I thought this GPS business was "spot on" down to a manhole cover. Well, it CAN be, and read on because we're going to tell you how the United States government is giving us free signals to correct this potential of a 300-foot error from our true position.

WHY THE ERRORS?

The biggest error is purposely induced by the Department of Defense to deny spot-on enemy missile accuracy by unfriendly forces. This error is called "selective availability," abbreviated S/A, and it means that we have been (as civilians) selected NOT to be available for decoding the secondary L2 precise military encrypted P-CODE.

There are also man-made errors that can throw off position accuracy using GPS, in addition to selective availability:

Selective availability	± 100 foot errors
Ionospheric errors	± 25 feet
Tropospheric errors	5 feet
Clock/ephemeris errors	15 feet
Multipath errors	5 feet
Noise	5 feet
Poor geometry errors	70 feet

If we could decode the restricted L2 frequency, we could minimize our atmospheric and ionospheric errors by 50 to 75 feet. This is because we could determine signal-path errors better by looking at the difference between two widely spread frequencies, rather than just one.

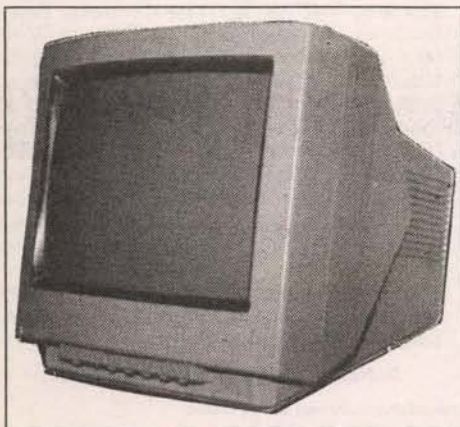
We can also minimize poor geometry errors by letting our GPS receiver sit in a specific position and self-calculate where the greatest number of position fixes take place on the screen. In fact, I do that regularly in our communications van, and can generally spot my REAL position down to 20 feet or so after letting the equipment "settle in" for a few minutes.

But the biggest error comes from the military — on purpose —



MAGELLAN GPS MAP'N TRACK

13" COLOR MONITOR



Composite input, RGB, EGA, & CGA compatible. Green switch and black and white switch. Following controls: Hue, saturation, contrast, & brightness. Used, but in great shape.

\$50.00 ea.

Shipping \$12.00

VISA & MC

Call Roger @

General Science & Engineering.

716-338-7001

SATELLITE TV — HACKERS 'BIBLE'!

The SECRETS are REVEALED!

- The principles of security
- Descrambler building blocks
- Smart cards, information wars & stupid mistakes
- Cracking codes (includes DirecTV source code)
- Installing and hooking up descramblers
- Video manipulative systems...and much more...

CALL 800-483-2423

TO ORDER - Send \$60 plus \$4 s/h to:
Baylin Publications, 1905 Mariposa, Boulder, CO 80302

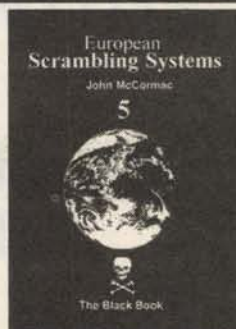
MASTER, VISA & AMEX /COD orders accepted

Telephone: 303-449-4551

FAX: 303-939-8720

E-Mail: fbaylin@baylin.com

FREE CATALOG — Satellite TV books, videos and software



576 pages, 6" x 8-1/2"
NEW!
5th Edition

and this is why your GPS may show you going one or two MPH in a certain direction, even though you are standing absolutely still. If you plot your track (even the little \$99.00 Magellan can do this), you will see that Uncle Sam is taking you for a phantom ride within the radius of a 300-foot circle; and if you sit still, you'll begin to see that you're at a specific spot within that circle because you constantly keep going through ground zero.

On the car navigation GPS systems, many contain a mapping algorithm that will not only keep track of your GPS position, but also keep track of roads around you. After you go straight, turn left, and then turn right, the expensive software begins to match your GPS position with known roadways, and then self-corrects so your automobile is now straight down the charted road. But the little handheld GPS sets might not have this comparison software, so occasionally you will see yourself going down the highway,

Here is some of the testing we did on portable GPS equipment that includes street maps and RV parks. This is inside the author's 21-foot Roadtrek.



and when you zoom in, see that you are slightly over on the right shoulder. But usually on a four-lane road, the little inexpensive Garmin Street Pilot GPS will clearly show you on one side of the road going north, and when you travel back, show you on the other side of the road.

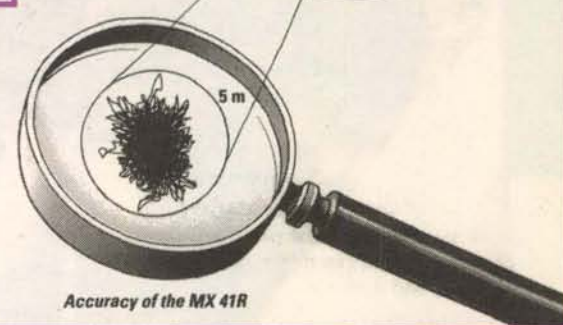
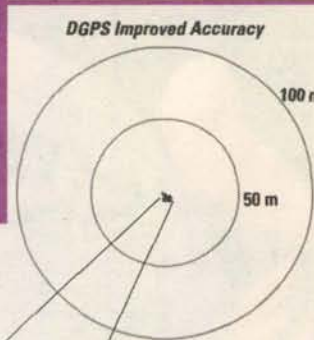
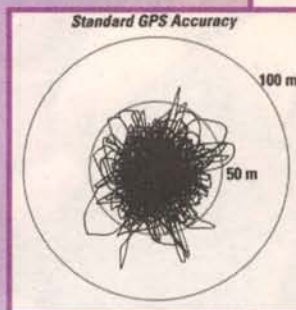
You are out on the desert on a camping trip, and your better half loses their gold one-carat diamond ring in the sand. The wind is blowing like mad, and you didn't bring your metal detector. Can you mark your position with GPS, drive home to get the metal detector, and then return to that exact same spot within a couple of feet?

If you let your mobile GPS "settle in" for about 20 minutes, then mark your spot, chances are you'll be able to get back to that same spot within about 20 to 30 feet. But for a surveyor, this is not close enough. For a large super-tanker coming into a narrow navigational channel, the probability of a 300-foot error is out of the question.

The way we achieve spot-on accuracy for those that need to get back within a meter or so of their pre-memorized position is through *differential* GPS correction methods. Differential GPS relies on a local receiver with a *very* expensive GPS inside taking position measurements, and comparing them to a surveyed benchmark. For boaters, the differential reference receiver is usually at the entrance looking over a big harbor or channel. For the aviation industry, it may be at the end of a runway. And soon for the railroad and automobile industry, these differential reference stations will be set on benchmarks throughout the country.

The differential beacon receiver compares its EXACT position to what is calculated by the global positioning system satellites. Every couple of seconds, an error correction message is sent out to all local GPS receivers in the area to add or subtract XX number of feet at a specific heading in order to calculate their own exact position. The differential transmitter, for surveyors, is usually up in the 400-MHz region, or higher.

Position accuracy without (left) and with differential corrections.



You can subscribe to differential corrections by a receiver that picks up the signals on commercial FM music station sub-carrier channels. You tie in your differential beacon receiver to your little GPS that accepts a differential correction signal via the NMEA (National Marine Electronics Association) input port, and the receiver self-corrects on the information provided. If you want millimeter accuracy, you might pay over \$100.00 a month. If you're looking for sub-meter accuracy, it could cost you about \$50.00 a month. If you're just looking for 10 to 30 feet accuracy, it might cost you *nothing* a month because these signals are already out there for EVERYONE to use.

The United States Coast Guard provides typical 10 to 15 foot correction accuracy signals for vessel harbor and harbor approach areas along the coastlines and rivers of the United States. The United States Coast Guard and other maritime authorities broadcast these differential signals on a discreet frequency between 283.5 KHz to 325.0 KHz.

"These beacon signals can be received hundreds of miles from the broadcast transmitters, including inland by motorists on the highways," comments Travis Gray, an applications engineer with CSI (Communications Systems International), in Calgary, Alberta. CSI manufactures and distributes 300-KHz differential GPS beacon receivers throughout the world (403-259-3311).

Unlike the pay-or-don't-get signals from cellular and FM sub-carriers, these powerful cor-

ACTIVE INDUSTRIES

Manufacturer of Cable-Related Products

1-800-305-6878

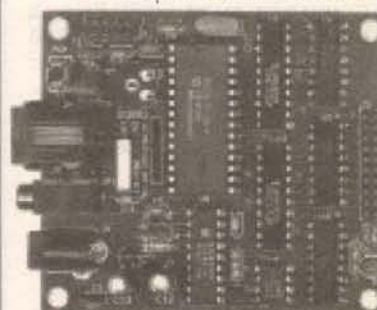
Motron

ELECTRONICS Eugene, Oregon 97402

<http://www.motron.com>

310 Garfield St Suite 4
PO Box 2748

DTMF Remote Controller
Only \$99.00 Plus S/H



VISA, MasterCard, AMERICAN EXPRESS, DISCOVER.
S/H: \$8 USA; \$11 CANADA; \$16 FOREIGN.

The Auto-Kall® AK-16 DTMF Controller Board features 16 relay driver outputs and DTMF to X-10 house control capability! Control the relay driver outputs, X-10 modules, or both with your radio keypad! X-10 operation requires the PL-513 Power Line Interface (\$20). The AK-16 mates readily with our **RB-8/10** (\$99) or **RB-16/10** (\$149) relay boards. The 0-12 digit security code is user programmable using your DTMF keypad. Additional features include re-programmable CW ID, CW response, and several modes of operation including Pan-Tilt Camera Control. The AK-16 is a fully assembled and tested printed circuit board.

Se Habla Español. Pida Por Don Moser.

Price and Specifications are subject to change without notice

Info: (541) 687-2118 **Orders: (800) 338-9058** Fax: (541) 687-2492



Furuno differential beacon receiver (DBR) for improved GPS accuracy. Works with almost all GPS equipment.

rection signals are absolutely free.

Any simple GPS receiver that is marketed as "differential ready" or "differentially capable" can accept a selection of RTCM SC-104 messages from a marine beacon receiver. The differential message standard provides 64 messages related to GPS and marine navigation. Message types 1 and 9 provide the most relevant data to non-precision DGPS, and include the pseudo-range correction values, range rate correction parameters, and satellite health information. Messages types 18 through 21 provide data relevant to precision DGPS. All of the United States Coast Guard dif-

ferential signals are absolutely free. the interior of the United States, and in a little over a year, additional signals will start popping up in the 283 KHz to 325 KHz band, now covering all US interior regions with solid differential correction signals.

PORTABLES ARE OUT — FOR NOW

The little handheld portable GPS can sit in a bracket, and plug into differential beacon correction signals if they are designed (as most are) with DGPS capabilities. However, when you have one stuck in your backpack, the receiver and its large antenna gets left behind, so your little handheld is now on its own. If you need spot-on DGPS capabilities, you'll need to drag along that extra board set and run it to a low-frequency loop or whip in order to obtain the correction signals down on the government beacon bands.

A few more problems. In downtown cities (where you could really use spot-on coverage), the weak incoming low-frequency MSK signals could get covered up by spark-plug noise and power-line noise. If you're trying to drive around town in a city more than 80 miles away from a local beacon transmitter, chances are your reception may be marginal and you'll notice your dash-mounted



GPS equipment can also read out speed, mileage, sunrise and sunset, latitude and longitude, direction, and mapping coordinates.

ferential GPS correction-sending stations are on the air, and for status updates, contact the US Coast Guard, Petaluma Control Center, at 707-765-7612 or 707-765-7613.

The correction message is sent on an existing Coast Guard radio beacon carrier frequency. In between the modulated CW dots and dashes for the radio beacon identifier, listen for the subtle modulation of the minimum shift-keying bit rate at 100 bps.

Board sets for the experimenter are available from CSI. One design that I like very well is their two independent receiver channel board — SBX-2 — which continuously monitors all beacon signals available for a particular location. The first channel tracks the primary station while the second channel continuously searches for other available beacons in the area. When the CSI SBX-2 board chip-set identifies a stronger signal, it will automatically switch to that station without operator intervention.

An HCMOS data interface level allows quick and easy integration with TTL and CMOS compatible GPS products. CSI also offers a wide selection of antennas for use with the SBX-2 engine. Options include an active E-field whip, or your choice of two H-field loop configurations,

GPS constantly blinking the differential reception icon.

I suppose if you're real serious about downtown DGPS coverage, you could sport a large ham radio 160-meter whip, and pull in signals this way. Or maybe it's time to invest in FM sub-carrier commercial differential signals that are unaffected by noise and big buildings.

Will the Department of Defense ever turn off selective availability signal dithering? Probably so — but according to experts in the industry, not for another 5 to 10 years. And even if they did turn off selective availability, you would still have a circle of error of about a 100-foot radius.

Ultimately, we may see differential beacon receivers carried on one of the incoming GPS channels directly from the satellite. Aeronautical users anticipate WAAS (wide area augmentation system) as one way of having a portable-type GPS with differential capabilities. This is still many years away.

But right now FREE correction signals are coming in from the US Coast Guard, and just starting up inland by the GWEN transmitting antenna takeover. But even if you don't have differential correction, the global positioning system is just fine for car-navigation receivers that

and a combination GPS/beacon antenna in a single enclosure.

And now more great news for the highway traveler wanting spot-on GPS accuracy, but not traveling down a road next to a Coast Guard differential beacon correction transmitting signal. The Department of Transportation and the railroad industry will soon be implementing abandoned government low-frequency GWEN transmitters throughout

RESOURCES

Magellan Systems Corp.

San Dimas, CA
909-394-5000

Garmin Int'l

Olathe, KS
913-397-8200

C-Map Technology

Mashpee, MA
508-477-8010

Ultra Data Systems Travel Star

St. Louis, MO
1-800-747-2605

BEACON, Dave Carter & Associates

219-522-2857

Trimble Navigation

Sunnyvale, CA
1-800-827-8000

Lowrance/Eagle

Catoosa, OK
918-438-8645

Etak, Inc.

Menlo Park, CA
1-800-765-0555

Bart, Bartizan American Communications

Sarasota, FL
941-955-7818

Navigation Technologies

Silicon Valley, CA
408-617-5000

Jeppesen Chart Cartridges

Aurora, OR
503-678-1431

Alpine Electronics

Torrance, CA
310-326-8000

Travroute Software

Princeton, NJ
1-888-872-8768

DeLorme

Freeport, ME
1-800-452-5931

EX2

West Chester, PA
1-800-392-7686

PRODUCTS IN THIS ARTICLE: The car navigation and GPS equipment mentioned in this article represents only those systems that author Gordon West has personally reviewed and operated. *Nuts & Volts* encourages product manufacturers not mentioned in this article to contact Gordon West at Gordon West Radio School, Inc., 2414 College Drive, Costa Mesa, CA 92626; 714-549-5000.

will dead-reckon you back onto the highway. And if you're driving down city streets looking at your position on a lap-top computer, those ETAK and DeLorme under-\$300.00 GPS systems are wonderful, and your position on the street maps will certainly be close enough that you can almost get down to driveway level.

Have you tried GPS? If you're really looking for a powerful portable entry-level GPS that has embedded highway cartography, check out the \$360.00 Garmin GPS III. It's quite a unit, and is the little brother to the Garmin Street Pilot that is now the hit of most RV operators.

Got GPS? **NV**

CALL TOLL FREE
(800) 292-7711 orders only
Se Habla Español

C&S SALES

EXCELLENCE IN SERVICE

CALL OR WRITE FOR OUR
NEW FREE 64 PAGE
CATALOG!
(800) 445-3201

REPAIR SYSTEM SOLDERING AND DESOLDERING Model SL-916

\$425.00

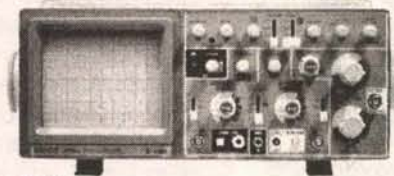
Top-of-the-line repair system will handle desoldering. Temperature controlled soldering from 300°F to 790°F (150°C to 420°C), desoldering temperature range 410°F to 900°F (210°C to 480°C). The system is based on principle of vacuum absorption of the solder from the PC board.



SL-928 - Desoldering System with Digital Display also available. \$325.00



Elenco Scopes Free Dust Cover and Probes



S-1325	25MHz		\$325
S-1330	25MHz	Delayed Sweep	\$439
S-1340	40MHz		\$475
S-1345	40MHz	Delayed Sweep	\$569
S-1360	60MHz	Delayed Sweep	\$749
S-1390	100MHz	Delayed Sweep	\$895

DIGITAL SCOPE SUPER SPECIALS

DS-203	20MHz/10Ms/s Analog/Digital	\$695
DS-303	40MHz/20Ms/s Analog/Digital	\$895
DS-603	60MHz/20Ms/s Analog/Digital	\$995

Four Functions In One Model MX-9300



\$459.95

Features:

- One instrument with four test and measuring systems:
 - 1.3GHz Frequency Counter
 - 2MHz Sweep Function Generator
 - Digital Multimeter
 - Digital Triple Power Supply - 0-30V @ 3A, 15V @ 1A, 5V @ 2A

NEW Tektronix DMMs

- 40,000 count
- High Accuracy
- Tektronix quality
- 3yr warranty

DMM 912	\$169	\$179
DMM 914	\$239	\$229
DMM 916	\$265	\$275



20MHz Sweep / Function Generator with Frequency Counter Model 4040

- 0.2Hz to 20MHz
- AM & FM modulation
- Burst Operation
- External Frequency counter to 30MHz
- Linear and Log sweep



10MHz Model 4017	\$309
5MHz Model 4011	\$239

\$399

Fluke Scopemeters



123...NEW...	\$950
92B.....	\$1445
96B.....	\$1695
97.....	\$1695
99B.....	\$2095
105B...NEW...	\$2495

ALL FLUKE
PRODUCTS
ON SALE

Technician Tool Kit Model TK-1500

28 tools plus a DMM contained in a large flexible tool case with a handle ideal for everyone on the go.



\$49.95

Fluke Multimeters			
Model 26III	\$195	Model 12	\$84
Model 70III	\$85	Model 83	\$235
Model 73III	\$115	Model 85	\$269
Model 75III	\$139	Model 87III	\$299
Model 77III	\$154	Model 863E	\$475
Model 79III	\$175	Model 867BE	\$650

B&K Precision Multimeters			
Model 389	\$109	Model 388A	\$99
Model 390	\$127	Model 2707	\$75
Model 391	\$143	Model 2860A	\$79
Model 5360	\$195	Model 5370	\$219
Model 5380	\$265	Model 5390	\$295

NEW DIGITAL LCR METER Model LCR-1810

- Capacitance .1pF to 20MF
- Inductance 1μH to 20H
- Resistance .01Ω to 2000MΩ
- Temperature -20°C to 750°C
- DC Volts 0 - 20V
- Frequency up to 15MHz
- Diode/Audible Continuity Test
- Signal Output Function
- 3 1/2 Digit Display

\$99.95



B&K High Current DC Power Supply

- Variable 3-14 VDC
- Thermal Protection
- Current Limiting

Model 1686 12A	\$159
Model 1686 25A	\$239

B & K 13.8V Fixed DC/Power Supplies	
Model 1680 6A	\$39
Model 1682 15A	\$75



Quad Power Supply Model XP-4

4 Fully Regulated DC Power Supplies in One Unit
4 DC voltages: 3 fixed - +5V @ 1A, -5V @ 250mA, +12V @ 500A • 1 Variable 0-12V @ 500mA



\$29.95

Digital Multimeter Model M-1740

\$39.95

Free Holster

11 functions including freq to 20MHz, cap to 20μF.
2 Year Warranty



Family Radio Model FRS-14

by Standard

- 1 Mile Range
- 1/2 Watt Output, 14 Channels
- LCD Channel & Code Display
- 38 Selectable Channel Codes
- Back-Lit Display
- No License Required!

**\$129.95 each or
2 for \$250.00**



Handheld Universal Counter

Features:

- 10-Digit LCD Display.
- 250MHz Direct Count.
- 16 Segment & RF Signal Strength Bargraph.
- NiCad Battery Included.



Model F-2800 1MHz - 2.8GHz

\$99

B&K Spectrum Analyzers



500MHz Series

BK2615A	\$1250
BK2620A	\$1675

- 150KHz to 500MHz
- Dynamic Range 80dB (113dB with attenuation)
- +20dBm maximum input
- 12.5 and 400KHz resolution bandwidth
- 150KHz/hour stability
- Built-in tracking generator (Model 2620A)

1.05GHz Series

BK2625A	\$1925
BK2630A	\$2595

- 150KHz to 1,050MHz
- Dynamic Range 80dB (113dB with attenuation)
- AM & FM demod included
- 20 and 400KHz resolution bandwidth
- 150KHz/hour stability
- Built-in tracking generator (Model 2630A)

Simm Module Tester B&K Precision Model 898

- Tests 72 and 30 pin SIMMs to 36 bits.
- Stands alone and portable. No other equipment required.
- Automatically identifies width, depth and speed of SIMMs.
- 10 built-in tests identify most memory defects Pre-heat cycle prior to tests.



\$625

Model XP-581

4 Fully Regulated DC Power Supplies in One Unit
4 DC voltages: 3 fixed +5V @ 3A, +12V @ 1A, -12V @ 1A
1 Variable - 2.5 - 20V @ 2A



\$89.95

Portable Semiconductor Tester B&K Precision Model 510

- In or out-of-order circuit tests for transistor, FETs, SCRs and darlington.



\$199

Satellite Finder Model SF-01

- Aligns Satellite Dishes
- Range 950-2050MHz
- Compact Size
- Self Power Check



\$39.95



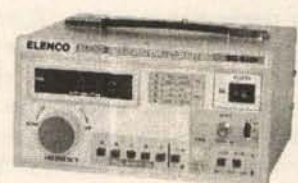
Dual-Display LCR Meter w/ Stat Functions B&K Model 878

\$219.95

Auto/manual range
Many features
with Q factor
High Accuracy

Digital Audio Generator SG-9300

\$175



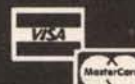
- 10Hz - 1MHz
- Low Distortion
- Sine/Square waves
- Built-in 150MHz Frequency Counter

Guaranteed Lowest Prices

C&S SALES, INC.

UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8.25% Sales Tax

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 541-9904 (847) 541-0710
http://www.elenco.com/cs_sales/



15 DAY MONEY BACK GUARANTEE

FULL FACTORY WARRANTY

PRICE'S SUBJECT TO CHANGE WITHOUT NOTICE

reader FeedBack

Dear Nuts & Volts:

The following refers to Tech Forum question #39816 - Mar. '98. Two answers to this question were printed in the May issue, however, they were both wrong.

The battery for the Metro Tel MT-911G is an Eveready 544A or equivalent, and is six volts.

Its purpose is to retain the stored phone number for the redial function. Since the memory is retained for 90 seconds after power is removed even when no battery is installed, and only works in rotary (pulse) mode, I have never installed one in mine. It also has a relatively short life unless the test set is always connected or the battery removed.

I have the original general description, specifications and maintenance manual for this unit, which I would be glad to copy and send if you provide a mailing address or fax number. It consists of three double-sided pages.

Robert Glasure
Freeport, FL

Dear Nuts & Volts:

In the "Reader Feedback" section of the May '98 issue, Mr. G. Zomber refers to an article by Mr. Carr that appeared in the January issue.

Mr. Zomber finds fault with Mr. Carr's statement regarding the voltage gain of the preamp that was designed by Mr. Carr. Mr. Carr says that the gain formula is $R2/R1+1$. I say that Mr. Carr is correct and Mr. Zomber is wrong.

The simple voltage gain formula without the "+1" applies only when $R1$ is driven with the input signal.

When the non-inverting input point (+) on the op-amp receives the input signal, the pesky little "+1" has to be considered. This is because all of the input signal appears across $R1$ which then gets added into the output.

This latter configuration is the one that Mr. Carr used in his preamplifier, hence the "+1" part is correct.

Interestingly, if $R1=R2$ the voltage gain is two — $R2/R1+1$.

Another bit of interesting trivia concerning this configuration is that there is no way to get a gain of one (sometimes called UNITY) or less than one. Try it.

R. Schroeder
Walnut, CA

Dear Nuts & Volts:

In response to your reader's comments about the "SignaMail" units sold by Alltronics in the Apr. '98 issue. I

test all of the units before they are shipped. All units go out the door fully tested and working properly.

First, out of the hundreds of receivers I have checked, only two have had music module or 4001 chip problems and were rejected.

Second, the units are very dependable and stable. Owing to the use of crystal-controlled FM transmitter and receiver, plus tone encoding, they are not prone to false signals and have a maximum range of about 500 feet.

The original price of these units was \$79.95 each. We still have refurbished units available at \$14.95 each. This is a unique device with lots of experimenter uses.

Alltronics does have a return policy.

Ken Terteling
Bench Technician
Alltronics

Correction:

I've become aware of an error in my April '98 article "Build A 'Super' Etching Tank."

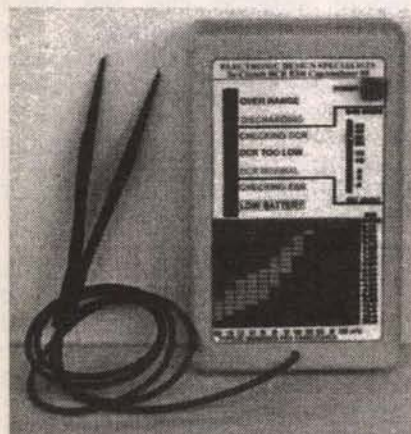
The diameter of the PCB support pin pictured in the middle right area of Figure 7 on page 100 should be 3/16 inch (it's incorrectly shown as 3/8 inch). The drill holes shown in the figure are correct, as is the description of the support pins in the parts list.

I apologize for any inconvenience this may have caused.

Larry Ball

New Product News

THE CAPANALYZER 88



Electronic Design Specialists introduces an in-circuit electrolytic capacitor checker that is guaranteed 100% accurate in circuit, with a money back guarantee. The The CapAnalyzer 88 automatically discharges the cap, measures DCR, checks for shorts, and measures ESR in circuit, all in one step.

Values from 0.47 uF to 2200

uF can be measured with 100% accuracy. Only 2.5 seconds is required for each cap, so that an entire PC board can be checked in just minutes.

All signals are under 50 millivolts with a 5-ohm test impedance to prevent semiconductors, resistors, or coils from causing false readings.

A slider control sets the value of DCR for the alarm beeper to warn the technician. The state-of-the-art design uses a microprocessor and a two-color 20 segment LED meter to read ESR with a resolution down to 0.1 ohm. A beeper allows eyes-off use by beeping from one to five beeps depending on the ESR reading and quality of the capacitor.

Included is a one-handed, gold-plated tweezer probe that can check both conventional and surface-mounted capacitors, and a handy three-color chart on the front panel that shows typical ESR readings for good and bad capaci-

tors in reference to their capacity.

It is battery-operated (AAA batteries) and handheld to make it easier to use, either in the shop or in the field. A three minute warning beeper alerts the technician that the unit is on if no testing is detected.

The CapAnalyzer 88 is available at most electronics distributors, as well as from EDS directly, for \$169.00.

For more information, contact:

**ELECTRONIC DESIGN
SPECIALISTS**
4647 APPALACHIAN ST.
DEPT. NV
BOCA RATON, FL 33428
561-487-6103

**THE WIRELESS
CONTROLGATE™**

Emge Industries, Inc.,
announces the introduction of

JFETS

ULTRA LOW NOISE

LS843 - 3nV/Hz typ

TIGHT MATCHING

LS843 - 1 mV max

- ◆ N & P Channel
- ◆ Duals & Singles
- ◆ Custom Screening
- ◆ Die, SMT, Thru-Hole
- ◆ No Order Minimum
- ◆ COD's Accepted

Second Source for Domestic
& Foreign JFETs & Bipolars

Full Service U.S. Manufacturer
of Specialty Linear Products

LINEAR SYSTEMS

4042 Clipper Court
Fremont, CA 94538
510-490-9160/510-353-0261(Fax)
E-mail: 3623671@MCIMAIL.COM

Write in 162 on Reader Service Card.

Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING...

with the AES learning system/
embedded control system.
Extensive manuals guide
you through your
development project.
All programming
and hardware details
explained. Complete schematics.
Learn to program the LCD, keypad
digital, analog, and serial I/O. for
your applications.



THREE MODELS AVAILABLE.
Choose from an Intel 8051,
Intel 8088, or Motorola 68HC11
based system.
All models come with:

- 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Digital, Analog, and Serial I/O • Interrupts, timers, chip-selects • 26 pin expansion connector • Built-in Logic Probe • Power Supply (can also be battery operated) • Powerful ROM MONITOR to help you program • Connects to your PC for programming or data logging (cable included) • Assembly, BASIC, and C programming (varies with model) • Program disks with Cross Assembler and many, well documented, program examples • User's Manuals: cover all details (over 500 pages) • Completely assembled and ready to use • Source code for all drivers and MONITOR • Optional Text Book

Everything you need. From \$279

Money Back Guarantee

Call for Free Info Pack, or see

WEB at <http://www.aesmicro.com>

714-550-8094, FAX 714-550-9941

Call 1-800-730-3232

AES
Advanced Educational Systems

AES 575 ANTON BLVD., SUITE 300, COSTA MESA, CA 92626, USA

Scott Edwards Electronics

NEW! Graphics LCD Module with Serial Interface



3.66" by 2.76"

The new G12864 makes it easy to display text and graphics on a 128-by-64-pixel LCD. It interfaces with a computer through a 2400 or 9600-baud RS-232 serial hookup.

Text Features

The G12864 works like a serial-receive terminal. It displays text in a 4-line by 16-character format. Text is displayed in a large 8- by 16-pixel font, which can be edited to include custom symbols.

Graphics Features

The display lets you plot points, draw lines, and display full-screen graphics using easy instructions. Its flash memory stores the text font plus 14 screens. You can create fonts and graphics on your PC, then download them to the G12864 using the included software.

Convenience Features

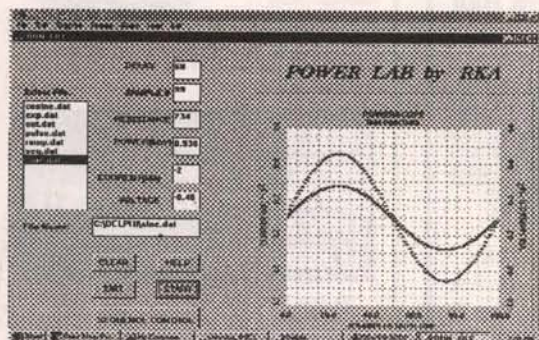
A power supply and DB9 serial-port connector are built in. Connect the display to the (included) AC adapter; plug the (included) serial cable into your PC or other computer, and you're ready to go. Current draw ranges from 15mA (typical, backlight off) to 100mA (max, backlight on). For complete specifications, see our web site: www.seetron.com.

Display, with starter pack: \$199 Display alone (OEM qty 1): \$179

Scott Edwards Electronics • PO Box 160 • Sierra Vista • AZ • 85636-0160
ph: 520-459-4802 • fax: 520-459-0623 • e-mail: info@seetron.com
Internet: www.seetron.com

Write in 96 on Reader Service Card.

PROGRAMMABLE POWER SUPPLY & DATA LOGGER



RKA SYSTEMS PRESENTS:

PROGRAMMABLE POWER SUPPLY

DATA LOGGER

WINDOWS ENVIRONMENT

EXCEL COMPATIBLE

- Programmable Power Supply (+/- 10 V, +/- 100mA)
- Virtual Digital Storage Scope(100 Samples Stored)
- Virtual Digital VOM (Volts,Current,Power,Resistance)

Applications:

- ◆ Lab Testing
- ◆ Voltage/Current Monitor

NOW ONLY
\$159.95

VISIT OUR WEB SITE AT:
<http://www.rkasys.com>



RKA Systems
484B Washington St. Unit #421
Monterey CA, 93940
Tel: 800 500 0449
Email info@rkasys.com

a new line of industrial radio remote controller modem systems designed to interface with electrically operated machinery and equipment. These systems are available in either simplex (one-way communication) or duplex (two-way communication) versions. A variety of analog, digital, RS-232, and RS-485 inputs and outputs are available for tailoring the system to the customer requirements.

The ControlGate™ ACE-928 utilizes state-of-the-art frequency hopping spread spectrum radio technology. Operating in the 902 to 928 MHz band, the ControlGate ACE-928 design offers unmatched noise immunity for the most stringent applications where communication reliability is of prime concern.

Electrical equipment or machinery controlled by a 0-5 VDC or 4-20 mA analog signal command can be safely and easily operated by the ControlGate ACE-928.

Eliminated by the ControlGate ACE-928 are the traditional wiring costs associated with long runs of control wiring and conduit to such devices as potentiometers, flowmeters, temperature sensors, pressure sensors, displacement sensors, velocity sensors, machine controllers, PLCs, and PCs.

The ControlGate ACE-928 systems also offer digital contact closures for simple ON-OFF commands. In addition, RS-232 and RS-485 ports are available on some models for easy computer interface. The duplex version offers standard two-way communication and the ability to setup a MODBUS network with master/slave units. Closed loop control is easily facilitated with the ControlGate products. All units are conveniently powered by low-voltage DC.

For more information, contact:

EMGE INDUSTRIES, INC.
1060 WINGFOOT ST., DEPT. NV
PLACENTIA, CA 92870-4444
714-996-5777
FAX: 714-996-5748

FIVE NEW ACCESSORY HEADS FOR PMM-1



Amprobe Instrument announces the release of their five new interchangeable accessory heads to expand the capabilities of their pen multimeter, model PMM-1. The accessory heads were designed with the HVAC

Technician in mind.

The complete series extends the PMM-1's existing testing capabilities from AC and DC volts and resistance to now measure capacitance (start/run capacitor testing), DC microamps (flame rod and flame sensor testing), relative humidity, carbon monoxide (IAQ testing), and single or differential temperature (compressor efficiency testing).

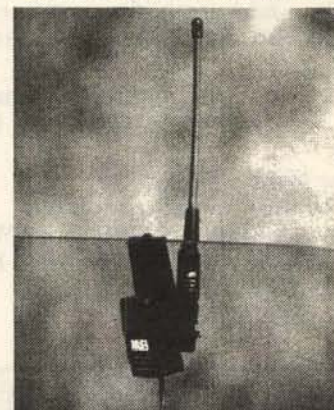
AC amps to 300A is accomplished with the existing accessory, model PMM-C.

Each new accessory head is designed to output imVDC per unit measured. The unique mechanical design allows each head to slide onto the PMM-1, but may be used with any DMM with a DC millivolt resolution in conjunction with the appropriate test lead, model TL-10S.

For more information, contact:

AMPROBE INSTRUMENT
630 MERRICK RD.
P.O. BOX 329
DEPT. NV
LYNBROOK, NY 11563
516-593-5600
FAX: 516-593-5682

MFJ-310 HT ANTENNA



MFJ Enterprises, Inc. announces the new MFJ-310 HT antenna ... only \$14.95.

With your HT antenna outside of the car in MFJ's new HT window mount antenna clip, the QSO range is greatly extended. The window mount clip with BNC connector holds your antenna securely on the outside of your car's window where it can radiate freely. It's quick and easy to install and can be tucked away discreetly in your car's glove compartment to eliminate theft problems.

The MFJ-310 HT window mount clip comes with 10 feet of flexible low-cost mini-coaxial cable. It easily can be pushed into tiny crevices in your automobile to make a comfortable mobile QSO.

For more information, contact:

MFJ ENTERPRISES, INC.
P.O. BOX 494, DEPT. NV
MISSISSIPPI STATE, MS 39762
601-323-5869
FAX: 601-323-6551
1-800-647-1800
E-MAIL:
mfj@mfjenterprises.com
WEB:
<http://www.mfjenterprises.com>

Tech America

Your Electronics Resource

TechAmerica Offers Thousands of Components, Plus Test & Measurement Equipment, Technical Books, Wire, Cable, Connectors and More!

We stock components and products to deliver immediately—No Minimum Order!
Take advantage of convenient telephone or fax ordering **7 days a week**.
Visit us online at **www.techam.com** for the latest information and offers!

**Where Else But TechAmerica
Can You Get Deals Like These?**



HALF PRICE!

\$74⁵⁰

WHILE QUANTITIES LAST
OFFER EXPIRES 6/30/98

EDSY INC.

Model 951SX

*A Popular Solder Station At
An Unbelievable Price!*

This temperature-controlled soldering station's iron heats to temperatures from 400 to 800°F, with precise regulation of ±6°F. Includes LT375 standard spade tip. When ordering, select from a wide variety of soldering and SMT crown tips (with retainer sleeve and adapter—sold separately). Tip-to-ground leakage less than 2mV. Tip-to-ground resistance less than 2Ω. External calibration capability helps with ISO-9000 standards compliance. Power rating: 15W-220W. Requires 70W/120V.

910-1901 Reg 149.00 Sale ea 74.50

**13.8VDC/23A
Power Supply**

Weights Only 3lbs., Measures Only 2.25x7x8.25"

Features binding post output terminals located on the back of a slimline case that matches your radio's footprint. With 23A continuous power, it's suitable for even 100W HF rigs! Designed with an advanced switching mode plus short-circuit and overload protection, this supply is virtually free of RF problems associated with switch-mode power supplies. Input voltage is 110-120/220-240VAC 50/60Hz. Output voltage is 13.8VDC. Output current is 23A continuous and 25A ICS. UL approved. (Mfr. Warranty: three-year limited. Size: 2.25x7x8.25" (HWD). Weight: 3 lbs.)

910-3916 Reg 119.95 Sale ea 79.95


SAMLEX AMERICA



\$79⁹⁵

OFFER EXPIRES 6/30/98

SAVE \$40!

Order Today! Call Toll-Free 1-800-877-0072

You Must Supply Special Code 28006 To Receive These Super Deals!

**To Receive Our FREE Monthly Full Color Flyer
Call 1-800-303-4450, ext. 28006.**

**Visit the TechAmerica Web Site at www.techam.com
to Subscribe to "TA Insider" E-Mail-Only
Specials—Exceptional Deals!**

TechAmerica makes no warranties of any kind, express or implied, including any warranty of merchantability or fitness for a particular purpose with regard to the merchandise. See page 399 of our catalog for our return policy and other terms and conditions of your order. ©1998 Delaware TechAmerica, Inc. All rights reserved. TechAmerica cannot be liable for pictorial or typographical inaccuracies. All product specifications, which include dimensions, are subject to change without notice. Prices shown are cash prices in U.S. dollars and are subject to change without notice. Shipping and handling fees are extra.

☐ **Yes! Please send me your monthly flyer! And, add me to your mailing list!**



Name (Please Print) _____

Company Name _____

Address _____

City _____

State _____

Zip _____

e-mail Address _____

By supplying your e-mail address you will receive special e-mail only offers tailored just for you.
Mail or fax completed form to:

TechAmerica, Dept. 28006

P.O. Box 1981, Fort Worth, Texas 76101-1981

Toll Free Fax: 1-800-813-0087

980-0002/0100

by Joseph J. Carr

Open Channel

Some Practical Matters

Wow! Did I get a lot of letters and E-Mail when I discussed the things they don't teach in school (or is that "teach in school anymore")! It seems that I've touched a hot button. Apparently, a lot of people are concerned with what engineers and electronic technicians are learning in schools today ... or not learning. What I did not get was even one letter that told I'm full of bullfeathers. One expects some big changes, because technologies change, but some things are a bit ridiculous.

One fellow told me that he has seen both mechanical and electrical engineers hired at his company recently that could write software in five or six different software languages, but could not read a mechanical drawing for the product they were building. That would be fine if all of a product was software, without any mechanical or electrical

stuff. My new car contains a heckuva lot of software, but it also contains tires, an engine, and a couple dozen electronic boxes — including a CD player which lets me listen to my pre-1965 hillbilly music (I know, I know ... I'm a musical antediluvian).

A friend of mine is the director of a biomedical engineering laboratory in a major hospital. When I did that kind of work in the 1970s, every technician you hired could troubleshoot to the component level. Even a kid right out of the community college could learn the art of troubleshooting in short order. But my friend tells me that he has to go through a large number of applicants to find a component-level troubleshooter. And even then sometimes his positions have to be filled with less than desirable applicants who seem trainable.

It can be argued that printed circuit board swapping is the way to go

today. And that is often true, especially on equipment that has such intense post-repair testing protocols that a "certified" board from the original equipment manufacturer is the best solution. However, even an up-to-date institution like my friend's hospital will have a large collection of equipment of mixed ages up to 20 years old or so. Try buying a printed circuit board for a 20-year-old scientific or medical electronic device!

At one time, I was a pretty hot shot troubleshooter (I made my living in electronic repair for 16 years before getting my college degree). Sometimes, troubleshooting boils down to experience driven instinct. For example, one time when I was repairing a DC power supply in a piece of medical equipment, with my boss (a Ph.D. engineer) looking over my shoulder, I surprised the boss with seemingly magic ability.

The comparison amplifier was an older style op-amp made with seven PNP and NPN silicon transistors. It was a genuine ambiguity group because they were DC coupled with hefty doses of feedback. I looked at the situation, pointed to one transistor, and told the boss, "it's that one!"

It was, indeed, "that one!" The boss was mystified as to how I knew it was "that one!" Actually, I didn't know it for sure. But knowledge is often probabilistic. There were seven transistors in the circuit. Six of them were metal can TO-5 devices, and one was the equivalent device, but in a plastic package. At that time (in the

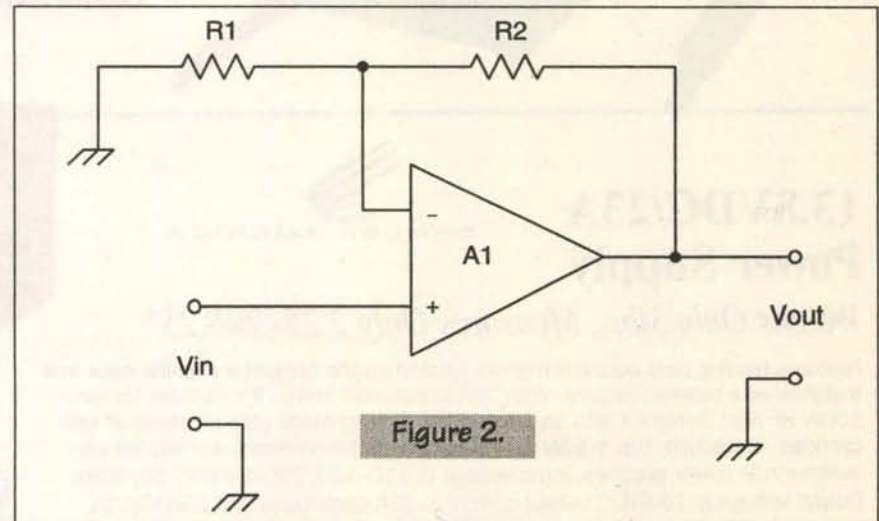
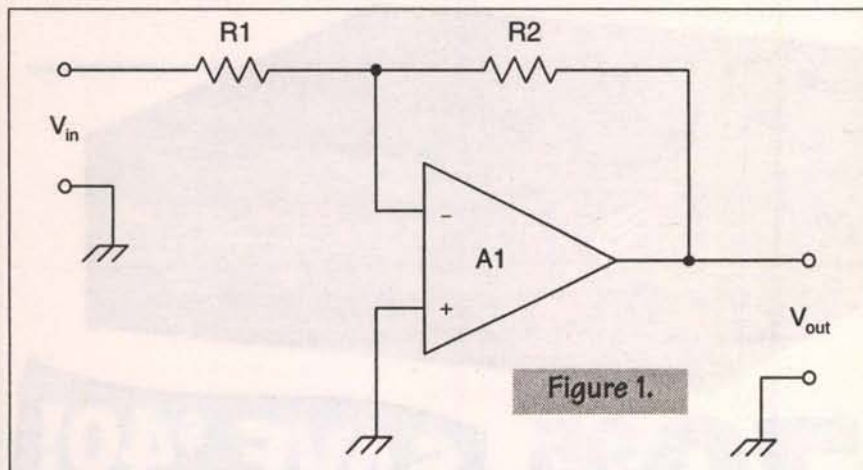
1970s), plastic transistors had a failure rate well over 10 times that of the same device in metal cans. Why? Dunno. But my experience bore out what all the other technicians believed (DoD would not permit plastic transistors in its electronics because of the reliability problem).

Brilliant, huh? No, not really. Any two-bit technician could do the same after having replaced about a gazillion plastic transistors and only a few TO-5 metal devices.

A Bit About Op-Amps

The operational amplifier is an interesting device. As a means of illustrating some practical electronics matters, let's take a look at this popular IC amplifier. It can produce high-voltage gains by setting two resistors. It is the ratio of the two resistors that sets the overall gain, so the circuit designer can exercise a great deal of control over things. Figure 1 shows the basic inverting configuration for the op-amp. Notice that the op-amp has two inputs. The inverting input ("-IN" or "-") produces an output signal that is 180 degrees out of phase with the input signal. In other words, a positive going input signal will produce a negative going output signal. The non-inverting input ("IN" or "+") has exactly the same amount of gain as the inverting input, but produces an output signal that is in-phase with the input signal.

An implication of this arrangement is that the output will be zero



EPROM+

A professional system for service and development

A DEVICE PROGRAMMER FOR BENCH AND FIELD

FIRST GENERATION EPROMS (24 PIN) 2708, TMS2716*, 1702*
SECOND GENERATION EPROMS (24,28,32 PIN) 2516,32,64,68764/66, 2716,32,64,128,256,512,513,011,010,101,1001,020,2001,040,4001,080,8001 (40,42 PIN*) 27C210,1024,220,2048,240,4002,4096,27C400,800, 27C160 (16MEG)
EEPROMS/NVRAMS (18-32 PIN) X2210/12,2804,16,17,64,65,256,512,010,ER5901,12XXX
FLASH EPROMS (28,32 PIN) [28F] [29C] [29EE] [29F] 256,257,512,001BX,010,101,020,040
SERIAL EPROMS (8 PIN INCLUDES C,CS,L,C,E) [2401] 02,04,08,16,21,32,44,64,65,256 [25010]020,040,080,160,320,640,128 [59C11]13,22 [8572]82,92 [9306]13,14,46,56,66,86 [95010] 020,040,080 [35C102]104,108 (14 PIN) ER1400, M58657
BIPOLAR PROMS (16 THROUGH 24 PIN) 82SXXX AND 74SXXX FAMILIES **FPGA CONFIGURATORS** [17C65] 128,256
PIC MICROS [12CXXX] [16C54] 55,56,57,58,55X [16C61] 62,63,64,65,62X [16C71] 73,74,71X [16C84] [16F8X] [14000]
MICROCONTROLLERS (8 BIT) [8741]42,48,49 [8751] C51,5X,C5XX [87C75X] [89C51] 52,55 [89C1051] 2051
MOTOROLA MICROS [68705P3] U3,R3 [68HC705C8] C9,J2,P9 [68HC711E9] D3
* REQUIRES SNAP-IN ADAPTER (DIAGRAMS INCLUDED OR PURCHASE ASSEMBLED AND TESTED)

- READ, PROGRAM, COPY, COMPARE, DISK FILE LOAD & SAVE (PLUS MORE!)
- FULL SCREEN BUFFER EDITOR WITH 25 COMMANDS PLUS BYTE & WORD MODES
- READS INTEL HEX/EXTENDED HEX, MOTOROLA S-RECORD AND BINARY FILES
- SOFTWARE RUNS UNDER DOS, WINDOWS 3.1 OR 95 ON ANY SPEED MACHINE
- PARALLEL PRINTER CABLE AND POWER PACK STORE INSIDE UNIT (9"X6"X3")
- 1 YEAR WARRANTY - 30 DAY MONEY BACK GUARANTEE

COMPLETE SYSTEM INCLUDES: PROGRAMMING UNIT, SOFTWARE PRINTER PORT CABLE, POWER PACK AND PRINTED MANUAL

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OHIO 45150

(513) 831-9708 FAX (513) 831-7562

website - www.arlabs.com

email - arlabs@worldnet.att.net

MADE IN THE U.S.A.

\$289

\$5.00 SHIPPING - \$5.00 C.O.D.
VISA • MASTERCARD • AMEX

CABLE TV

CONVERTERS

MOST MAJOR BRANDS

MISC.

ALL YOUR CABLE NEEDS

NOTCH FILTERS

CHANNELS 3, AND 14 THRU 23

WE SPECIALIZE IN **QUANTITY** DISCOUNTS

KD
VIDEO

CALL:

1-800-327-3407

Write in 30 on Reader Service Card.

when exactly the same signal is applied to both inputs simultaneously. This has tremendous impact on the usefulness of the op-amp in certain electronic instrumentation situations, such as amplifying a Wheatstone bridge output or suppressing noise signals.

The ideal op-amp has an infinite open loop (i.e. no feedback) voltage gain, although making that claim for real devices is ludicrous. It is true, however, that modern devices have gains in excess of 1,000,000 and even cheapies can offer 250,000. An implication of this feature of the op-amp is that the closed loop gain can be set solely by the ratio of two resistors in a resistive voltage divider feedback network. In Figure 1 those resistors are R1 and R2. The gain of this circuit is found from:

$$A_v = \frac{-R_2}{R_1}$$

where: A_v is the closed loop voltage gain, and R1 and R2 are the values of the two resistors. The negative sign is used to indicate that a phase reversal takes place between input and output terminals (which is why they call it an "inverting follower amplifier").

Let's say we want to make a voltage amplifier with a gain of, say, 100. That means we can use a 100-ohm resistor for R1 and a 1,000-ohm resistor for R2. The ratio is 1,000/100 = 10, so everything is all right. Right? No, not by a long shot. Let's take a look at why.

But first, let me digress a bit. More than 20 years ago, I built a small amplifier for a physiologist to use with a Wheatstone bridge gram-force transducer. He actually wanted me to write a technical description for a physiology journal article he was writing ("publish or perish" looms large to young scientists). One of the "peer review" critics, who knew nothing about operational amplifiers, insisted that the amplifier would not work because "everyone knows" that op-amps have an infinite, or at least very, very high input impedance, so would be subject to a lot of noise." At the request of my scientist friend, I wrote a rebuttal that discussed the concept of "virtual ground."

This brain teaser causes some consternation with newcomers, but it quite logically follows from one of the properties of the ideal op-amp: both inputs stick together. That is, whatever you do to one input, it's the same as if you had done it to both. Thus, if you apply a potential, say one volt, to the non-inverting input, then you will measure the same potential on the inverting input. Note in Figure 1 that the non-inverting input is grounded, so is at zero volts potential. That means, by this property, that the inverting input will also be at zero voltage potential. Thus, it will behave as if it were physically grounded!

So what's wrong with our scenario in which R1 = 100 ohms? Nothing, if the source impedance is minuscule. The input impedance of this circuit is essentially the parallel combination of R1 and R2, or since R2 >> R1, it is dominated by R1. We

thus can claim that $R_{IN} = R_1$. Let's say our input signal source is a voltage source that has an inherent internal resistance of 25 ohms (not an unreasonable number). It could be very much higher if a photoresistor or thermistor circuit were the source. If we place a 1 volt input signal at V_{IN} , then we would expect the output voltage to be $V_O = V_{IN} \times (R_2/R_1) = (1V)(-10) = -10V$. But it won't be 10 volts with the scenario concocted. The actual input voltage seen by the op-amp is reduced by the amount calculated from the voltage divider equation:

$$V_{IN(ACTUAL)} = V_{IN} \times \frac{R_1}{R_1 + R_s} = (1V) \times \left(\frac{100 \Omega}{(100 + 25) \Omega} \right) = (1V)(0.8) = 0.8 \text{ volts}$$

Thus, the actual output voltage will be $(-0.8V)(10) = -8 \text{ volts}$ — a 20 percent error. What the designer of our 100-ohm input amplifier failed to do was consider the minimum allowable value for R1 to prevent a serious error from voltage divider action. The general rule of thumb is that $R_1 > 10R_s$ for sloppy circuits, and $R_1 > 100R_s$ for more reasonable circuits. Thus, for a source resistance of 25 ohms, $R_1 > 2,500 \text{ ohms}$. That would make the minimum design for a gain of 10 amplifier $R_1 = 2,500 \text{ ohms}$ and $R_2 = 25,000 \text{ ohms}$. As a practical matter, since 2.7K and 27K are standard resistor values, those would normally be selected.

It's also possible to pick input resistors that are too high. The reason is that the nice little op-amp does not have an infinite input impedance (as the books claim), but in fact has a finite input impedance. One can expect an input bias current to flow out of the input, rather than zero current. The ideal op-amp input will neither sink nor source current, but the real op-amp might produce anywhere from a few nanoamperes to a couple milliamperes. That current will

flow in both R1 and R2, creating a voltage drop that is seen by the op-amp as a spurious voltage input. If the values of R1 and R2 are high, then that DC offset signal can be substantial. As a result, some designers place a compensating resistance between the non-inverting input and ground that has a value equal to the parallel combination of R1 and R2.

Figure 2 shows a different form of op-amp circuit. This one uses the same operational amplifier, but is a non-inverting amplifier. In other words, the output signal is in-phase with the input signal. The feedback

network is similar, except that one end of resistor R1 is grounded, rather than being connected to the signal source. The signal is, instead, applied to the non-inverting input. The gain of this circuit is found from:

$$A_v = \frac{R_2}{R_1} + 1$$

Note there is no negative sign, which indicates that this circuit does not invert the input signal.

What kind of problems might exist when this circuit is used as shown? One problem is that the input is open any time the amplifier is not connected to a signal source. In some cases, this means the amplifier will oscillate at some frequency or another. In other cases, it can mean the output voltage will snap to a high value DC voltage close to one of the power supply rails. To prevent this requires a resistor from the non-inverting input to ground. Keep in mind the input resistance restrictions given above for the inverting follower. In reality, however, because the

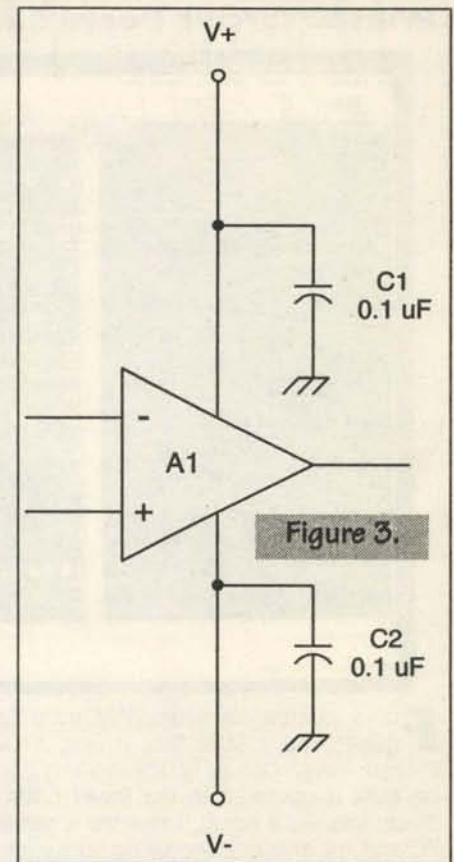
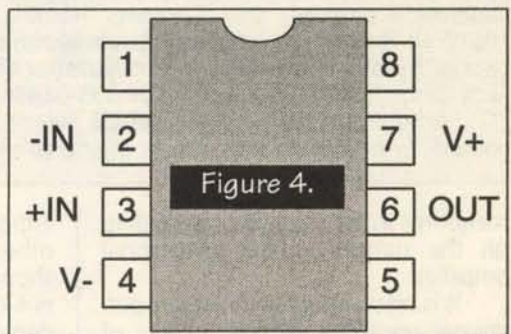


Figure 3.

input resistor is not used for setting gain, it can be almost any high value. It is not uncommon to find resistors between 100 Kohms and 10



Network Service Tool Set

Popular installation and service tools for networks, modems and telephones. All hand tools are professional heavy duty type.

Use the compact tester on 10BASE-T (UTP & STP), thin Ethernet (BNC), 8-position Token Ring, AT&T 258A and EIA/TIA 568A/B. Automatically scans cables for continuity, wiring sequence and polarization. Tests STP cable ground. Testing installed cables is easy with Remote Terminator and gender changers (UTP and BNC). 9V battery included.

- Coax Stripping Tool, RG-58 & RG-59
- BNC Crimping Tool, RG-58 & RG-59
- Modular Cutting/Stripping/Crimping Tool (4, 6 & 8-Position)
- Multi-Network Cable Tester
- AC Receptacle Tester
- Cable Cutter

Order No. 55625 \$197.00



PC Service Tool Set

Contains all tools needed to troubleshoot & service IBM-compatible PCs. Set includes:

- AMI Diagnostic Software
- POST Card
- Logic Probe
- Digital Multi-Meter
- AC Receptacle Tester
- Serial Adapter
- Serial & Parallel Loopback Connectors
- DIP IC Puller
- PLCC IC Puller
- Grounding Wrist Strap
- Key Top Puller

Order No. 55000 \$198.00



CALL TODAY!

800-854-7393



PC Diagnostic Tool Set

- AMI Diagnostic Software
- POST Card

Order No. 55555 \$89.00

Network Installation Tool Set

- Network Tool Set 55625 without the Multi-Network Cable Tester.

Order No. 55600 \$99.00

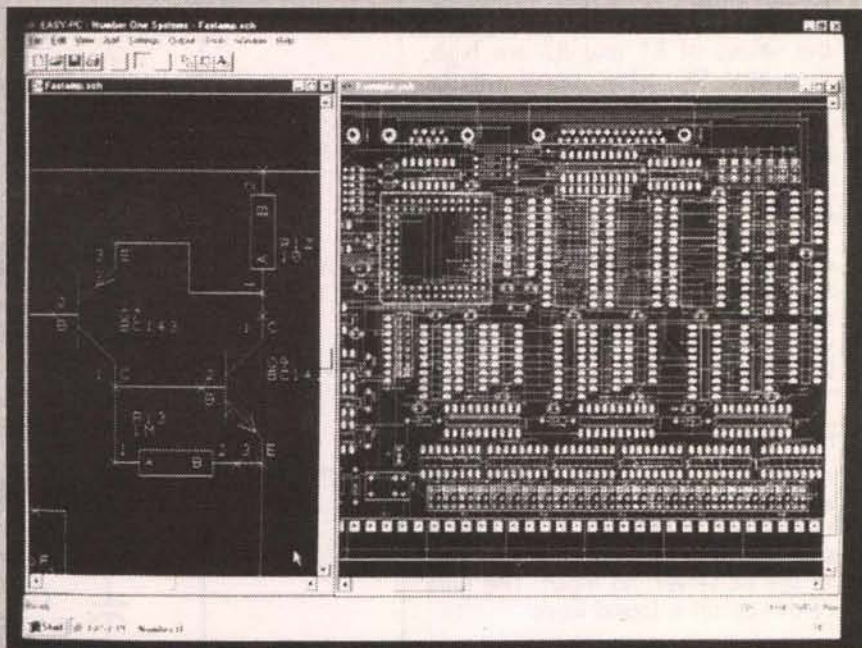
Call for your FREE Catalog

Graymark®

P.O. Box 2015 Tustin, CA 92781

<http://www.labvolt.com>

Printed Circuit Board Software



For a number of years, I've used Easy-PC to layout printed circuit boards. It gripped me a little that it was a DOS-based program in a Windows-95 era. Indeed, I even had difficulty running Easy-PC on one of my Windows 3.1 machines because it operated in the lower 640K of RAM, and I had other things running there, too. As a result, I needed a separate systems configuration file to run Easy-PC and my antenna modeling software.

Now the producers of Easy-PC (Number One Systems in England) has a Windows-compatible version. Figure 5 shows an example of the Easy-PC for Windows graphical user interface. And it isn't merely the DOS program with a Visual Basic shell for Windows. It's an all new product. You can see the product at the web site, which has the URL <http://www.numberone.com>. In the UK, the address is **Number One Systems**, Harding Way, St. Ives, Huntingdon, Cambs. PE17 4WR, UK. E-Mail to sales@numberone.com. In the United States, the product is available from a distributor: **Number One Systems**, 126 Smith Creek Drive, Los Gatos, CA 95030; phone 408-395-0249.

Another product is **ExpressPCB**, which also has a service that produces the boards from your designs. Check their web site at <http://www.expresspcb.com>.

megohms in this position, depending on the nature of the operational amplifier.

It is relatively easy to make operational amplifiers oscillate instead of amplify. Sometimes the oscillation shows up as a high-frequency oscillation that dominates the output signal with its high amplitude. Often, however, the signal is more subtle than that. It will show up as a whispy oscillation on top of the regular output signal. One of the most common problems that causes oscillation is that the builder failed to provide bypass capacitors at the DC power supply terminals (Figure 3).

Two bypass capacitors are needed because there are two DC power supplies. The V- power supply is negative with respect to common or ground, while the V+ power supply is positive with respect to common or ground. Note, however, that the op-amp itself does not have a ground terminal. The input and output signal common or ground for the amplifier is taken from the common or ground of the two DC power supplies.

The capacitors used for decoupling the amplifier should be mounted as close to the body of the device as possible. Typically mylar or some other small, modern form of 0.1 μ F capacitors are used.

Most modern op-amps are sold in the eight-pin mini-DIP package (Figure 4). The pin-outs shown in Figure 4 are the "industry standard" or "741-family" connections. Most single op-amps follow this protocol,

although some devices follow some other pin-out scheme. The pins not shown labeled will be either offset null or frequency compensation pins, depending upon the device (see data

sheets).

Now let's assume that you have built an operational amplifier circuit, and it doesn't work. What do you do? The first step is to take a DC voltmeter and find out what voltages are present on the pins. First, check that the V- and V+ voltages are present. If one or both of those voltages are missing, then the circuit will not work.

Next check the output terminal and read the voltage present. It should be near zero. The trick is to find out whether or not the input terminals are capable of controlling the output. Short the two input pins (-IN and +IN, or 2-3 in Figure 4) together and note any change of the output voltage. If the output voltage drops to zero (as it should if the amplifier device is working), then the IC is capable of working. If the output voltage is some other voltage, then one must determine just why. Several things come to mind. First, are the DC power supply voltages present and of proper value? If not, find out why. Next, make sure that any null circuit is set to zero volts potential, or is disconnected. If the output voltage still remains high, then consider whether or not the device is bad (replace it and see).

Another indication of a bad device is a DC offset voltage (it doesn't have to be close to the DC power supply rail). If there is, say, a 2.5 volt DC level on the output terminal even when the inputs are shorted together, and the null circuit (if any) is either disconnected or set to

For Further Reading

Several of my books deal with operational amplifier circuits. They can be ordered through any book store, most electronics parts distributors, or through Amazon Books on-line (<http://www.amazon.com>).

Joseph J. Carr. *Electronic Circuit Guidebook Volume 3: Op-Amps*. ISBN 0-7906-1131-7. Howard W. Sams/PROMPT Publishing.

Joseph J. Carr. *Linear IC Applications: A Designer's Handbook*. ISBN 0-7506-3370-0. Butterworth-Heinemann/Newnes.

Joseph J. Carr. *Linear Integrated Circuits*. ISBN 0-7506-2591-0. Butterworth-Heinemann/Newnes.

zero, then the device is probably bad.

In future columns, we will take some more looks at analog electronics circuits from both the design-and-build and troubleshooting perspectives. If there are any particular topics you would like to see, then contact me at the address shown elsewhere. NV

Community College Instructors

I would like to hear from community college and four-year BSET program instructors in electronics technology programs. I am interested in finding out how well your programs are faring, how they are changing, and what the future looks like for the programs in this electronics age. Contact me at the postal and/or E-Mail addresses listed.

Connections ...

I can be reached by snail mail at P.O. Box 1099, Falls Church, VA 22041, or via E-Mail at CARRJJ@AOL.COM.

TONER CARTRIDGE RECHARGE

& Laser Printer Supplies

CALL NOW FOR YOUR FREE CATALOG #13!



Instruction Manual
Free with starter kit



Video Training Tapes
choose from our library



Catalog #13
100 pages
FREE!



Marketing Flyers
with customized pricing



Printer/Copier/Fax
Cross Reference
68 pgs-Free
with any order

■ Black, Color & MICR Toners
■ Tools and Accessories
■ Technical Support

■ Cartridge Parts
■ Video Training Tapes
■ OPC Drums and Belts

■ InkJet Refill Supplies
■ Graphic Black Toner Kits
■ MICR Toner Kits

Visit our website at

www.chenesko.com

for all the free tech documents, Sales Specials and the latest industry news!



Chenesko Products Inc.
2221 Fifth Ave., Suite 4,
Bunkinoma, NY 11779
Fax: 516-467-3223
E-Mail: chenesko@aol.com
<http://www.chenesko.com>

800-221-3516

ACP's 86th GIANT COMPUTER SWAP★MEET

Orange County's Original! All Day Sunday 8am-2pm

Be a Seller ...for your space Call Mary

July 26th

FREE Admission & Parking Shop 100's of Sellers

in ACP's Giant Parking Lot !!!

Advanced Computer Products, Inc.

ACP SUPER★STORE Since 1976

1310 E. Edinger Santa Ana, CA 714-558-8813

COMPUTER CIRCULATION CENTER, Inc.

dba: Alltech Electronics

2618 Temple Heights Drive.

Oceanside, CA 92056

Phone Order Hours 9AM - 5:30PM Mon-Fri

Phone Orders

760/724-2404

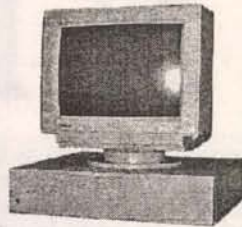
\$25 -Min. Order -



9350 Clairemont Mesa, San Diego - 619/573-0411
1401 El Camino Real, Oceanside - 760/721-0093
1300 E. Edinger, Santa Ana - 714/543-5011
2018 W. Lomita BLVD, Lomita - 310/539-2260
We buy surplus & excess computer inventory
as well as scrap electronics related inventory.

Refurbished Computer Systems

AST 386 • 8MB • Refurb VGA
Monitor • 120 MB HD ..\$120.00
486DX2/66 • 16 MB • 200 MB
New SVGA Monitor • \$299.00
Systems Include Keyboard and
1.44 MB Floppy
You supply software & go!



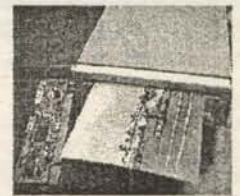
Starting at...
\$120!

Be sure to check
our Web Site for
more information
on these and other
products!

www.allelec.com

Easy Photo Drive

Easy to use photo scanner!
Scans up to 5" x 7"



200 <--> 400 dpi
Scans in about 10 seconds! **\$49.00**

Fits right into your computer in a 5.25" drive bay!

\$79.00

Attaches to the
USB port on
your computer.
No additional
hardware
needed. Use it
for Video
Capture,
Internet Phone,



USB CCD Camera

FLOPPY & ZIP SCSI DRIVES

3.5" NEW 720K\$5.00
3.5" NEW 1.44MB\$16.00
SCSI Zip Drive External
Refurb\$79.00

PC KEYBOARD / MOUSE

AT 101 Keyboard\$9.95
9 Pin Serial Mouse\$6.95

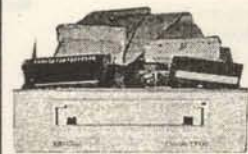
Internet Camera Video Conferencing

\$149.00

Buy 2 & Save
\$10.00!
Includes MS
Netmeeting 2.0.
Quality Phillips
CCD Camera.
Great package!
See our website
for more details.



TapeStor 800 & 3200



Seagate Connor
Refurbished TR1
TR1 800MB
TR3 3.2GB
Floppy Vers.
Only 5/W &
Cables included.
TR-1 Tape \$10.00
w/drive purchase
T3200 3.2GB
TR3...\$69.00

\$39.00



Great for projects!
About the size of a
red brick. With
built in fan.
+5 @ 10A, -5 @ 3A
+12 @ 1.5A, -12 @ 3A
Very nice P/S.

\$9.00

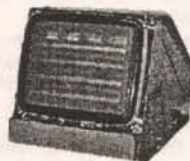
See Web for more
details.

Compact 80W DC P/S!

10" Open Frame Color SVGA!

Up to 1024 x
768 resolution
110V AC
operation.
AC and VGA
cable
attached.
Ready to go!

\$119.00



\$7.95

1.3" 20 Meg IDE HD

HP Kittyhawk
20 Meg 1.3 Inch
Fits almost any-
where. Standard 44
Pin IDE Pinout.
Master/Slave
Selectable

External SCSI Cases \$29.00 & Up



5.25" Closed HH \$29.
5.25" Open HH \$35.
5.25" Open FH \$45.
3.5" Open for Zip,
Syquest, etc... \$29.
All cases have two 50
pin centronics
connectors.

HP Printer P/S

\$29.00

4 Pin "L"
shaped connec-
tor, two styles,
one labeled
20VAC, other
10VAC
CenterTap.
Same output.



\$29.00

Aerospace Woofer

8.5" x 8.5" x 3.5"
100/300Hz
Selectable
Plugs into exist-
ing system. Has
two stereo line
outs, 1 line in.
Everything you
need.

Original Apple
OEM Part.
1.5Amp output.
Needed for
Color & Type III
Batteries. Older
Duo's charge
batteries faster
with this one.

\$29.00



**Apple
PowerBook Duo P/S**



\$9.95

iomega ZipDrive P/S

Epson Zip labeled.
+5V @ 1.5A.
VERY SMALL &
LIGHT WEIGHT
1.5" x 2.75"
Replace that big
bulky brick.

CPUs

486SX 25/33\$3.00 ..\$5.00
486SX2-66\$8.00 ..\$8.00
486DX25/33\$5.00 ..\$8.00
486DX2-50/2-66\$18.00 ..\$29.00
486DX4-100\$49.00 ..\$49.00
Pentium 75/90\$45.00 ..\$55.00
Pentium 100 / 133\$65.00 ..\$75.00
Pentium 166\$99.00 ..\$99.00

Upgrade
Your
System



EPROMs

2716 /273275¢
2764 /27128\$1.50
27256 /27512 ...\$2.00
1Meg\$2.50
2 Meg\$3.50

RAM Chips

4Meg x 9-80\$15.00
1x32-70\$9.00
2x32-70\$19.00
4x32-70\$35.00
1 meg x9-10\$2.00
1 meg x9-80\$3.00
1 meg x9-70\$4.00

IDE Hard Drives

420 Meg\$59.00
320 Meg\$49.00
270 Meg\$40.00
120 Meg\$35.00
80 Meg.....\$25.00
40 Meg.....\$15.00



PC Oldies but Goodies

EGA/CGA Card -or- ISA Super I/O\$14.95
2 Meg AT Memory Card - or - Parallel/Mono Card \$9.00
Floppy Controller -or- Serial / Parallel Card\$6.95
VLB 1 Meg VGA Card - or - 386 Motherboard w/2 Meg \$19.95
16 Bit (ISA) VGA w 256/512/1 Meg\$9.00 / \$12.00 / \$14.95
VLB Super I/O\$12.95
8 Bit VGA Card - or - XT Motherboard w/640K.....\$9.95

Modems

External or Internal PC 2400\$9.95
Internal PC 9600\$12.95
Internal PC 144/Fax.....\$15.95
External Practical Peripherals 144 (Pacakged for
Mac, but works with anything).....\$19.00
PCMCIA 144 Modem (Various).....\$29.00

CD ROM & Sound Cards

4x IDE Internal\$29.00
8x IDE Internal\$39.00
24x IDE Internal\$59.00
4x SCSI Internal.....\$39.00
4x SCSI External.....\$69.00
Ensoniq SoundScape w/on board CPU\$49.00
ExpertColor 16 bit SB Pro Compatible\$14.95
Universal Audio Cable (CD ROM to Soundcard)\$4.95

[HTTP://WWW.ALLELEC.COM](http://WWW.ALLELEC.COM)

VISIT OUR WEB PAGE DAILY FOR SPECIALS & MORE INFO. ON THESE ITEMS

Events

JUNE 1998

JUNE 5-6-7

MI - MT. CLEMENS - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

TX - ARLINGTON - West Gulf Division Convention. Tom Gentry K5VOU, 972-442-1721

JUNE 6

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

CANADA - QUEBEC - MONTREAL - ARC Hamfest. James Hay VE2VE, 514-697-7205. E-Mail: jrhay@haya.qc.ca

ME - HERMON - Pine State ARC Hamfest. Hermon High School. 8am-1pm. Roger Dole KA1TKS, 207-848-3846

MI - GRAND RAPIDS - Annual Hamfest. Hudsonville Fairgrounds, off I-96 x-way. Randy N8KQX, 616-532-5450

MI - TAYLOR - Super Computer Sales. Democratic Club Hall, 23400 Wick Rd. 10am-3pm. Computers And You 734-283-1754. Web: www.gatecom.com

NC - CHARLOTTE - Hamfest & Computer Fair. Roll-A-Round Skate Ctr., 8830 E. Harris Blvd., 7:30am-12:30pm. Charlotte ARC, PO Box 33582, Charlotte, NC 28233. E-Mail: w4cq@qsl.net

TN - NASHVILLE - ARC Hamfest. TN State Fairgrounds. 8am-5pm. Bob Malone WB5ZDS, 615-865-6225

JUNE 6-7

CA - SACRAMENTO - Computer Show. Cal Expo. MarketPro 415-456-6730

FL - ORLANDO - Computer Show. Central FL Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

KY - LOUISVILLE - Computer Show. KY Fair & Expo Ctr. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

MD - TIMONIUM - Computer Show. MD State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

NY - WHITE PLAINS - Computer Show. Westchester County Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

PA - KING OF PRUSSIA - Computer Show. Valley Forge Convention Ctr. 9:30am-4pm. MarketPro 301-984-0880

TN - MEMPHIS - Computer Show. Agricenter Int'l. 9:30am-4pm. MarketPro 301-984-0880

WA - DRYDEN - Apple City ARC Hamfest. Greg Johnson WA7TSP, 509-663-1081. E-Mail: g.c.johnson@mail.print.com

JUNE 7

CALENDAR

The Events Calendar is a free service limited to electronic events such as computer shows, hamfests, flea markets, etc. If your organization is sponsoring an event and would like a free listing, contact us at least 60 days prior to the event. Include your flyer, estimated attendance, name of the person to contact, and phone number.

Complimentary issues are available upon request for distribution to your attendees. A street address for UPS is required.

While we strive for accuracy in our calendar, we can not be responsible for errors or cancellations. The information contained in this column is for the use of the readers of *Nuts & Volts* and may not be republished in any form without the written permission of T & L Publications, Inc.

All listing information should be sent to:

Nuts & Volts Magazine

Events Calendar

430 Princland Court

Corona, CA 91719

Phone 909-371-8497

Fax 909-371-3052

E-mail events@nutsvolts.com

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Anklam 510-447-3857

CA - SAN DIEGO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: http://marketpro.com

CT - NEWINGTON - AR League Hamfest. Newington High School, Willard Ave. Rte. 173. 9am-1pm. Ralph Borriello N1VIM, 860-828-1695. E-Mail: rborriello@snet.net

IL - PRINCETON - Starved Rock RC Hamfest. Debbie Burton N9DRU, 815-795-2201. E-Mail: dbkatz@mtco.com

Web: http://www.prairienet.org/srrc/

IN - WABASH - County ARC Hamfest. 4-H Fairgrounds, State Rd. 13N. Don Spangler W9HNO, 219-563-8487. Web: http://www.netusal.net/~qrziota/

MA - TAUNTON - Computer Show. Holiday Inn. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

MI - MADISON HEIGHTS - Super Computer Sales. J.F. & C.W. Hall, 876 Horace Brown Dr. 10am-4pm. Computers And You 734-283-1754. Web: www.gatecom.com

NY - QUEENS - Hamfest. NY Hall of Science Parking Lot, Flushing Meadow Corona Park, 47-01 111th St. Stephen Greenbaum WB2KDG, 718-898-5599 night only. E-Mail: WB2KDG@bigfoot.com

OH - MEDINA - Two Meter Group Hamfest. Medina County Fairgrounds Community Center, 735 Lafayette Rd. 8am-3pm. Mike Rubaszewski N8TZY, 330-273-1519. E-Mail: N8TZY@aol.com

PA - ALLENTOWN - Computer Show. Days Inn Conference Ctr. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: www.petertrapp.com

PA - BUTLER - Hamfest. Butler Farm Show Grounds. 8am-4pm. George Artnak N3FXW, 412-854-5593. Web: http://www.users.sgi.net/~wolfie/

VA - MANASSAS - Ole Virginia Hams ARC

Hamfest. Prince William County Fairgrounds, Rt. 234. Mary Lu Blasdel KB4EFP, 703-369-2877

WI - JUNCTION CITY - Swapfest & Auction. US Army Reserve Ctr. John Feltz W9JN, 715-457-2506. E-Mail: jfw9jn@tzn.net.com

JUNE 12-13

GA - ALBANY - ARC Hamfest. Arthur Shipley N4GPJ, 912-439-7055

JUNE 12-13-14-15

NY - ELLENVILLE - Chaverim Int'l Convention. Fallsview Hotel. Arnold Halpern W2GDS, 732-222-3009. E-Mail: w2gds@juno.com

JUNE 13

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

CANADA - ONTARIO - FERGUS - Guelph & Kitchener-Waterloo ARCs Hamfest. Bill Smith VE3WHS, 519-821-6642. E-Mail: smith.ve3whs@sympatico.ca

ID - RATHDRUM - Hamfest. Lions Club, Hwy 53. Jim Monroe 808-667-4915. E-Mail: jmonroe@dm.net

KY - PADUCAH - ARA Hamfest. Executive Inn Convention Ctr. 8am-3pm. Craig Martindale WA4WBQ, 502-444-6822

MA - DENNIS - Cape Cod Tailgate Swapfest. 8am-3pm. Don Haaker WA1AIC, 508-760-1571

MI - LIVONIA - Super Computer Sales. Livonia Elks Lodge Hall, 31117 Plymouth Rd. 10am-3pm. Computers And You 734-283-1754. Web: www.gatecom.com

NH - SEABROOK - Computer Show. Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

NY - BUFFALO - Computer Show. Hamburg Fairgrounds. 9:30am-4pm. MarketPro 201-825-2229.

Web: http://www.marketpro.com

NY - CORTLAND - Skyline ARC Hamfest. Andrew Slaugh KB2LUV, 607-753-0597. E-Mail: sany@sanyps.com

PA - HARRISBURG - Computer Show. PA Farm Show Complex, East Bldg. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: www.petertrapp.com

VA - ANNANDALE - Computer Show. Northern VA Community College. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

JUNE 13-14

GA - DALTON - Computer show. North GA Fairgrounds. Georgia Mountain Productions 706-838-4827

FL - TAMPA - Computer Show. FL State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

IN - FT. WAYNE - Computer Show. Memorial Coliseum. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

NY - LAKE GROVE - Computer Show. Sports Plus. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

OH - COLUMBUS - Computer Show. OH Expo Ctr. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

PA - ALLENTOWN - Computer Show. Allentown Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

VA - VIRGINIA BEACH - Computer Show. Virginia Beach Pavillion. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

JUNE 14

IL - WHEATON - Six Meter Club of Chicago Hamfest. DuPage County Fairgrounds, 2015 Manchester Rd. Joseph Gutwein WA9RIJ, 630-963-4922

BLUE LEDs ARE HERE

HURRY! We have just received a quantity of brilliant blue LEDs. These are sold by others for much more. We have stocked blue LEDs before, but these are the brightest and best that we have ever seen. Each has a diffused light blue case. Produces very nice blue light! Very hard to find item.

T1 Case (3 mm) G9493 \$2.25 ea. 10 for \$20 100 for \$180
T1-3/4 Case (5 mm) G9494 \$2.50 ea. 10 for \$23 100 for \$210

POWERFUL KNF HEAVY-DUTY DC LIQUID PUMP

Very high quality pump has a membrane pump mechanism to allow for a variety of different liquids to be pumped. These precision pumps were made for laboratory or industrial use. The original costs of these were probably in the \$150 to \$300 neighborhood. These are used excellent condition and can be powered from 12V solar panels, batteries etc. Voltage range is 12VDC up to 28VDC. At 12 VDC we pumped a quart of water in 90 seconds. At 24VDC we pumped it in 45 seconds. Self priming type with fittings for 1/4" tubing on input. Size about 5" x 5". Has rubber cushioned mounting base. These are used excellent condition. Sale expires 8-15-98

DIGITAL DISPLAY PEN TYPE AC/DC VOLTAGE DETECTOR G9414 \$24.95

This amazing device can detect AC volts, even through insulation, and can also be used as a handy continuity tester. It is very unusual in that it does not use batteries, yet provides indications on a small LCD display. As the probe tip is brought near a line cord, which is plugged into 120VAC a "V" symbol is displayed on the LCD display (no need to touch the probe tip to a live wire as it can detect the presence of AC through insulation). Will also measure approximate AC or DC voltage level from 12V - 220V AC or DC and will display a digital approximation (12V, 36V, 55V, 110V, 220V) if probe tip is touched to a "hot" wire. Can also identify blown fuses, circuit breakers, faulty insulation, etc. Very handy brand new in retail blister package. G9569 \$2.98

HEAVY DUTY AIRPAX

SERVO MOTOR

Airpax Model C82902-M2 is 2 1/16" dia. with mounting ears on 3" centers. Features 2.7V operation with ohms/coil .97, step angle 7.5°. Has 5/8" L x 1/4" dia. "D" shaft. Standard four lead type with 2 ft. long flexible leads. Brand new! No other data available. G9547 \$4.95

1 FARAD SUPER CAP

Giant capacity in a small size! This cap is only 1 1/8" dia x 7/16" H but is rated a whopping 1 Farad @ 5.5VDC. Use this to store the energy from solar cells to run motors, light LEDs, power radios. You'll be amazed at how long the charge on these lasts before you need to re-charge them. They are like a super compact, high capacity rechargeable battery! Brand new with metal post leads and vinyl wrap. G9439 \$2.49

HONEYWELL MOTION ACTIVATED SECURITY CONTROL

Turns lights or appliances on when you enter a room and off when you leave, without touching a switch. Now you don't need to fumble around looking for light switches. This motion activated control senses you entering the room, turns on a lamp or small appliance, and then turns it off when you leave. Adds a measure of safety and security to any room in your home. Small 4 1/2" x 2 1/2" almond and grey unit sits on any surface and controls lamps and small appliances (up to 400 watts). Maximum range 15 ft. Lights can be operated manually at any time. No installation required. Brand new in sealed retail blister pack. Model # CL850D-1002. G9497 \$8.95

COMPLETE WIRELESS VIDEO SECURITY SYSTEM

Consists of a high quality 900 MHz wireless B/W TV camera, which can operate from 7 AA batteries (not included) or an AC adapter (included), also a special 900 MHz wireless B/W receiver unit with adapter which can be used with any standard TV, VCR or monitor you have. No need to buy a monitor—just connect the output of the receiver ("F") type to your TV or VCR antenna input. One of the easiest to use and best quality picture and sound units around. Range is stated as 120 ft., but we found a maximum of 60 ft. works best. Camera transmits audio and video, has a built in microphone, a 1/3" CCD image sensor with 78° fixed wide-angle lens, an "LED" on indicator, a mounting bar and base and 2 channel operation so you can use 2 cameras in same vicinity without interference. Receiver has 2 channel capability, plus an auto switch function that displays one camera output for a while and then the second camera (if you have one) output. Complete ready to go system consisting of one dual channel camera, one receiver, AC adapters and hardware for a ridiculously low price. Note: these were dealer demos or returns from customers that did not know how to hook them up (very simple), so they may have a slight case scratch (most do not). We 100% test each system to make sure it works perfectly. Hurry, don't be disappointed, as we sell out of video systems very fast! G9486 \$109.00 COMPLETE SYSTEM G9324 \$79.95 EXTRA CAMERA/ADAPTER

SMALL DC MOTOR WITH WORM GEAR

These are type FF-180PH Mabuchi motors with a plastic worm gear with gear brace. Size of motor 1 1/4" L x 13/16" x 9/16". Operates from 1.5VDC up to 12VDC. Great for hundreds of applications including robotics. Worm gear is 3/8" L x 5/16" dia. Has solder terminals. G9558 \$1.59

ELECTRONIC GOLDMINE
WE ALSO OFFER OVER 150 DIFFERENT ELECTRONIC KITS.
ELECTRONIC GOLDMINE
PO Box 5408
Scottsdale, AZ 85261
http://www.goldmine-elec.com
NOTE: All items subject to prior sale

For Phone Orders Call: 800-445-0697
or Fax Your Orders to: (602) 661-8259
For a Free Catalog Call: (602) 451-7454
Foreign catalog request: send \$5.00

Minimum Order: \$10.00 (plus min. \$5.00 Shipping and Handling). We accept MasterCard, Visa and personal checks, however, we cannot accept personal checks on orders outside the United States. Minimum Foreign Order Amount: \$50.00 (plus a minimum \$10.00 S&H)

AMPLIFIED JAZZ STEREO SPEAKERS

Great for computers, CD players, headphone radios, tape players, etc.! These compact amplified speakers produce high quality room filling sound from almost any sound source. Features volume control, on/off switch and AC adapter. Will also run on 3 "C" batteries (not included). With 3.5MM stereo plug and flexible cable. White color Model # J-201. Brand new in box! G9499 \$9.95

LARGE GEARED MOTOR

Looks like this could be used in robot applications or anywhere a high torque forward motion is needed. Consists of a 3 1/2" L x 1 3/8" Dia. motor that has a bridge rectifier attached to its power input leads. The bridge allows for operation from 12V up to 120V AC or DC. The shaft of the motor is a worm gear connected to a rotating 3/4" Dia. white plastic gear. The arrangement provides a tremendous forward movement. However, the motor shaft itself cannot be reversed, because the worm gear only operates in one direction (that's why the bridge rectifier is attached). Brand new! G9485 \$3.95

Events CALENDAR

KY - ERLANGER - Ham-O-Rama '98. Lions Park. 8am-3pm. Robert Blocher N8JMV, 513-797-7252
E-Mail: krod@tso.cin.ix.net

MD - NEW CARROLLTON - Computer Show. Ramada Conference & Exhibition Ctr. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

MI - FLINT - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988

MI - GRAND RAPIDS - Super Computer Sales. Crowne Plaza, 5700 28th St. S.E. 10am-4pm. Computers And You 734-283-1754.
Web: www.gatecom.com

NH - MANCHESTER - Computer Show. Holiday Inn Expo Center. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

NY - BETHPAGE - Hamfest. Briarcliffe College, 1055 Stewart Ave. 9am-2pm. Richie Selzer N2WJL, 516-520-9311. E-Mail: N2WJL@juno.com
Web: http://www.limarc.org

NY - BINGHAMTON - Computer Show. The Showplace. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: www.petertrapp.com

NY - ROCHESTER - Computer Show. The Dome Ctr. 9:30am-4pm. MarketPro 201-825-2229.
Web: http://www.marketpro.com

OH - SUFFIELD - Hamfest. Wingfoot Lake Park, 10 miles east of Akron. Ken Phillips K8CHE, 330-733-5795.

TN - KNOXVILLE - Hamfest & Electronics Flea Market. National Guard Armory, 3330 Sutherland Ave. 9am-4pm. David Bower K4PZT, 423-974-5064. E-Mail: d.bower@ieee.org
Web: http://www.kornet.org/rack

JUNE 19-20-21

GA - ATLANTA - Hamfestival '98. Greg Barrett N5BDJ, 770-649-1467.
E-Mail: gbjb@mindspring.com
Web: http://www.saf.com/arc

JUNE 20

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

MI - DEARBORN - Super Computer Sales. Dearborn Civic Center, 15801 Michigan Ave. 10am-3pm. Computers And You 734-283-1754.
Web: www.gatecom.com

MI - MIDLAND - Hamfest. Midland County Fairgrounds, 8am-1pm. Jeff Weinberg 517-636-0643 (w) 517-839-9371 (h). E-Mail: w8cq@bytethis.com

NH - NASHUA - Computer Show. Sheraton Tara. Northern Computer Shows 978-744-8440.
E-Mail: inquiries@ncshows.com

NJ - DUNELLEN - Raritan Valley RC Hamfest. Columbia Park. 7am-2pm. Bob Pearson WB2CVL, 908-846-2056. RWPEARSON-WB2CVL@WORLDNET.ATT.NET

OH - AKRON - Computer Show. Summit Co. Fairgrounds, 10am-3pm. Peter Trapp Shows 603-272-5008. Web: www.petertrapp.com

VA - BLUEFIELD - Hamfest. Brushfork Armory. Don Williams WA4K, 540-326-3338.
E-Mail: wa4k@sara.org
Web: http://www.inetone.net/erarc/hamfest/

WV - BLUEFIELD - Hamfest. Brushfork Armory.

Don Williams WA4K, 540-326-3338.

E-Mail: wa4k@sara.org

Web: http://www.inetone.net/erarc/hamfest/

JUNE 20-21

FL - WEST PALM BEACH - Computer Show. South FL Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

GA - KENNESAW - Computer Show. Outlet Mall, I-75 @ Exit 117. Georgia Mountain Productions 706-838-4827

MD - GAITHERSBURG - Computer Show. Montgomery Co. Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

NJ - SECAUCUS - Computer Show. Meadowlands Exposition Ctr. 9:30am-4pm. MarketPro 201-825-2229.
Web: http://www.marketpro.com

PA - HARRISBURG - Computer Show. Farm Show Complex. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

PA - MONROEVILLE - Computer Show. Pittsburgh Expo Mart. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

WV - CHARLESTON - Computer Show. Charleston Civic Ctr. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

JUNE 21

IN - CROWN POINT - Lake Co. ARC Hamfest. Lake Co. Fairgrounds. Malcolm Lunsford W9MAL, 219-769-3925. E-Mail: w9mal@cris.com

MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altembernd KA1MQX, 617-253-3776.
http://web.mit.edu/wlmx/www/swapfest.html

MD - FREDERICK - ARC Hamfest. Eric Gammeter N8AAV, 301-865-0865

MI - LANSING - Super Computer Sales. Holiday Inn South Convention Ctr., 6820 S. Cedar St. 10am-4pm. Computers And You 734-283-1754.
Web: www.gatecom.com

MI - MONROE - Monroe Co. Radio Comm. Assn Hamfest. Fred VanDaele KA8EBI, 313-242-9487

OH - CLEVELAND - Computer show. Cuyahoga Co. Fairgrounds. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: www.petertrapp.com

OH - MACEDONIA - Cuyahoga ARS Hamfest. Rich James N8FIL, 1-800-404-2282.
http://www.cars.org

JUNE 26-27-28

MI - TAYLOR - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 734-287-2000

JUNE 27

DE - NEWARK - Computer Show. University of DE. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

FL - FT. MCCOY - Hamfest. Tom Bench KT4VF, 352-546-3967. E-Mail: w4frc@qsl.net
Web: http://www.qsl.net/w4frc

MI - KALAMAZOO - Super Computer Sales. Kalamazoo Co. Fairgrounds, 2900 Lake St. 10am-3pm. Computers And You 734-283-1754.
Web: www.gatecom.com

VA - CHANTILLY - Computer Show. Capital Expo

Ctr. 9:30am-4pm. MarketPro 301-984-0880

Web: www.marketproshows.com

VA - RICHMOND - Computer Show. The Showplace. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

JUNE 27-28

FL - JACKSONVILLE - Computer Show. Morocco Shrine Auditorium. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

NJ - SOMERSET - Computer Show. Garden State Exhibit Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

OH - SHARONVILLE - Computer Show. Sharonville Convention Ctr. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

TN - KNOXVILLE - Computer Show. TN Valley Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

JUNE 28

IL - GLEN ELLYN - Computer Show & Sale. College of DuPage. Main Arena of Phys Ed Bldg. Corner of Park Blvd. & College Rd. 9:30am-3pm. Computer Central Shows 847-940-7547

MD - UPPER MARLBORO - Computer Show. The Show Place Arena. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

MI - FARMINGTON HILLS - Super Computer Sales. Farmington Hills Activity Ctr., 28600 Eleven Mile Rd. 10am-3pm. Computers And You 734-283-1754. Web: www.gatecom.com

PA - WILKES-BARRE - Computer Show. Genetti's Best Western. 9:30am-4pm. MarketPro 301-984-0880 Web: www.marketproshows.com

VA - ROANOKE - Computer Show. Roanoke Civic Ctr. 9:30am-4pm. MarketPro 301-984-0880
Web: www.marketproshows.com

JULY 1998

JULY 3-4-5

MI - MT. CLEMENS - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

JULY 4

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

PA - DILLSBURG - Harrisburg RAC Hamfest. Monaghan Fire Hall, 245 W. Siddonsburg Rd. Michael Kalbaugh N3HLK, 717-232-6087. fabinfo@fabral.com n3njb@juno.com

JULY 5

MI - GRAND RAPIDS - Super Computer Sales. Crowne Plaza, 5700 28th St. S.E. 10am-4pm. Computers And You 734-283-1754.
Web: www.gatecom.com

OH - LISBON - Hamfest & Computer Show. Columbiana County Fairgrounds. 8am-3pm. Dick Sisley K3JKB, 330-385-1245

PA - WILKES-BARRE - Murgas ARC Hamfest. Robert J. Michael WB3FAA, 717-288-3532

JULY 10-11-12

ND - DUNSEITH - Int'l Hamfest. Int'l Peace Garden. Rt. 1 Box 116. Dave Snyder VE4XN, Canada 204-728-2463. Lynn Nelson W0CQ, USA 701-839-8200

JULY 11

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

IN - INDIANAPOLIS - Central Division Convention. Rick Ogan N9LRR, 317-251-4407

KY - TOMPKINSVILLE - Hamfest. National Guard Armory, Hwy 163. J. Bunch 502-678-5784. E-Mail: dwelch@glasgow-ky.com

MI - PETOSKEY - Swap & Shop. Emmet Co. Fairgrounds. 8am-1pm. Clark Rouse KA8TIL, 616-582-6455

MO - KANSAS CITY - PHD ARA Hamfest. Bob Roske WA0CLR, 816-436-0069.
E-Mail: wa0clr@juno.com
http://www.tfs.net/~caltman/phdara/phdara.htm

NC - SALISBURY - NC Alligator Group Hamfest. Civic Center. 8am-1pm. Walter Bastow N4KVF, 704-279-3391. E-Mail: alligatorl@juno.com

OK - ALTUS - Altus Area ARA Hamfest. Ronald Hughes KB5JVC, 580-482-7994

WA - KENNEWICK - Tri Cities ARC Hamfest. Dick N7WLD, 509-783-3479.
E-Mail: dick_goranson@kcc-computers.com

WI - OAK CREEK - Swapfest. American Legion Post 434, 9327 S. Shepard Ave. 7am-2pm. 414-762-3235

JULY 12

IL - PEOTONE - Kankakee ARS Hamfest. Don Keruac K9NR, 815-939-7548. E-Mail: K9nr@juno.com
Web: http://www.geocities.com/CapeCanaveral/Hangar/5711/

MA - SWANSEA - Computer Show. Venus DeMilo. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

MI - FLINT - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988

NJ - AUGUSTA - Sussex Co. ARC Hamfest. Dan Carter N2ERH, 973-948-6999. E-Mail: scarncj@qsl.net Web: http://www.qsl.net/scarncj/

NY - ALEXANDER - Genesee Radio Amateurs Hamfest. David Carlson KA2OQZ, 716-786-3622. E-Mail: carlson@frontiernet.net Web: http://www.frontiernet.net/~wittman/wittman/GRAM

OH - BOWLING GREEN - Ham-A-Rama & Computer Show. Wood Co. Fairgrounds. 8am-1pm. 419-354-1811. E-Mail: sjhudson@wcnet.org

PA - KIMBERTON - Valley Forge Hamfest. Kimberton Fire Company Fairgrounds. Bob Haase W3SA, 610-293-1919.
E-Mail: wb3joe@voicenet.com

PA - PITTSBURGH - North Hills ARC Hamfest. Northland Public Library, 300 Cumberland Rd., 8am-3pm. Bob Ferrey, Jr. N3DOK, 412-367-2393. E-Mail: n3dok@pgh.net
Web: http://nharc.pgh.pa.us

JULY 17-19

MT - EAST GLACIER - MT State Convention. Gerry Leach VE6BVZ, 403-285-5547. E-Mail:

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

Modern Communications • (405) 691-0594 TEL & FAX

Converters

Converters:

	10	50	100+
Panasonic: TZPC175 ..	\$75.00	\$69.00	\$65.00
Centurion CF-3000 ...	\$65.00	\$60.00	\$55.00
DRZ-3 or DRX-3-105 ...	\$29.00	\$25.00	\$18.00

Remotes:

Jerrold: 400, 450, 550 ...	\$4.50	\$4.00	\$3.75
CFT: 2XXX	\$4.95	\$4.50	\$4.25
S/A: 075, 175, 475	\$4.95	\$4.50	\$4.25
S/A: 8600 Original	\$5.95	\$5.50	\$5.00
Zenith (ALL)	\$4.95	\$4.50	\$4.25
Tocom 5503-VIP	\$4.95	\$4.50	\$4.25
Pioneer (ALL)	\$4.95	\$4.50	\$4.25
Pioneer: Made in Korea ..	\$5.95	\$5.50	\$5.00



Parts, Parts, Parts

	50	200	500
18 VAC, 300 MA P/S	\$3.00	\$2.50	\$2.00
65.8 MHz Saw Filters	\$2.50	\$2.35	\$2.10
PIC16C54	\$2.20	\$2.10	\$2.00
PIC16C56	\$2.35	\$2.30	\$2.25
Micro 68H705C8P	\$9.50	\$9.00	\$8.50
4 MHz			
(Resonance 2 pins)	\$0.45	\$0.40	\$0.35

Call for FREE CATALOG
(405) 691-0594

Remotes

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

LIQUIDATING WAY Below Cost

as low as **\$25!** with another item **as low as 49!!** with another item



Shop the way the Pro's do, Use Their Tools!
These are the books that find the "Gold". For many years they've been used by the Sharpest Purchasing Agents. Look under every rock... they're impossible to find at ANY price, let alone a great deal like this. Find: Distributors, Manufacturers and Service providers for **Products, Services or ANY Component Parts** imaginable from **USA & Canada**. Sources for Everything from Gears to Semiconductors to Foreign Assembly Services. Find Products by Description or find ANY Company in the Electronics Industry. Chilton's (2Vol) EITD pinpoints companies who have what you need. The Famous Spring Technical's (3Vol) EPGD finds every distributor & we throw in an American Business CD covering the entire US.

\$25 ALL 6 Pcs Current Back issues
\$34 Above if Purchased Alone

\$55 98 Single Edition EITD (Chilton)
\$117 98 3 Edition EPGD (Springs Tech)
\$120 98 American Business CD

BIBLE of the IC INDUSTRY
The Best IC Reference Published. Nothing Else like it in the World! **100,000 ICs** of EVERY KIND & Every Manufacturer. Specifications, Selected Data Sheets, Every known Cross-reference, Alternate Sources, Manufacturer Profiles & Distributors. Perfect for Sales, Service, Engineering & Experimenters.

\$49 3 Vol Back Issue of Current Production ICs
Perfect for Service & Moderate Design Work
\$55 Above if Purchased Alone

\$195 \$129 97 Books, For Advanced Design Work
\$235 \$159 97 CD Rom
\$195 \$179 98 Books
\$235 \$199 98 CD Rom
Other Editions may be available

"REFEREE" Semiconductor & Directory Software

FREE buy both REFEREE & ICM **Coffee/Tea/Soup Warmer**

SEMICONDUCTOR CROSS REFERENCE & SPEC
Quarter Million Transistors, ICs & Diodes
A Specialist in "Hard to Cross House Numbers"
Easy, Powerful & Fast.
The Most Comprehensive Software Sold.

A selection yields Device Specifications & 75 to 250 Potential Replacements
Replacement Numbers are Totally Global including Domestic, Asian, European, House
Branded, as well as ECG, NTE, SK & GE. Displays Case Drawings, Lead
Configuration & Pin-outs for many Devices. Coverage of Replacement Numbers
is Very Impressive. 7 Disk Set (17 Meg decompressed) For DOS, Win3.1 & 95
Latest Version 7.11 Includes Many Helpful Conversion Utilities, Tables & Formulas.

Includes: 4 HUGE Consumer Electronics Industry Directories
1-Consumer Electronics Parts Sources (Service) 2-Consumer Electronics Manufacturers
3-The Entire Computer Industry 4-Semiconductor Manufacturers
Perfect for Service, Engineering and Purchasing.

EEM is the Largest Component Parts Directory available. All the Major
Parts Manufacturers display Entire Product Line Catalogs with
Pictures & Data sheets. Cabinets, Transformers, Pots, Semi's, Resistors,
Capacitors, Crystals, Coils, Connectors, Wire, Heat sinks, Switches, Fuses,
Speakers, Displays, an Endless list! Makes parts sourcing a snap.
The 4 Volume (18 Lb) EEM Set shown is available on CD ROM ONLY.

Bonus Largest Directory Made
Select Phone Liquidation
\$219 as low as **\$15!**
Business, Municipal & Residential
Sold for alone with any item
\$219 \$39! \$25!
SUPER BUYS
<<- 2 Versions >>>
\$89 \$29! \$15!
14 Million Businesses

All Cards & COD We don't sell semiconductors / NO catalog FAX 516-826-7776
Netcom 800-733-3733 ext 6300 516-826-1808 9am-9pm EST 7Days
22 June 1998/Nuts & Volts Magazine Write in 67 on Reader Service Card.

Events CALENDAR

leachg@cadvision.com

JULY 18
CA - ANGELS CAMP - Flea Market. Utica Park. 7am-2pm. Stephen Barnett KD6CNU, 209-878-3829
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
NC - CARY - Swapfest. Cary Community Ctr., 404 N. Academy. Cary ARC, PO Box 53, Cary, NC 27512
NH - SEABROOK - Computer Show. Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com
OH - WELLINGTON - Noarsfest. Lorain County Fairgrounds, 8am-3pm. Clark Beckman N8PZD, 216-671-8795
PA - SALEM TOWNSHIP - Computer & Hamfest. Beach Haven Carnival Grounds. Charlie AD3L, 717-864-2571
TX - TEXAS CITY - Tidelands ARS Hamfest. Carl W. Steele Jr. WA5WVP, 409-948-0308

JULY 19
IL - SUGAR GROVE - Fox River Radio League Hamfest. Waubesa Community College. James Von Olnhausen 630-897-3042. E-Mail: n9uzc@amsat.org
MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altemberd KA1MQX, 617-253-3776
<http://web.mit.edu/w1mx/www/swapfest.html>
MA - WORCESTER - Computer Show. Worcester Centrum Centre. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com
MO - WASHINGTON - Zero Beaters ARC Hamfest. Bernie E. Hillerman Park. 6am-2pm. Keith Wilson KOZH, 314-629-2264. E-Mail: n0mfd@amsat.org
URL: <http://zbarc.usmo.com>
NY - FARMINGVILLE - Radio Central ARC Hamfest. Jo Ann Colletti N2IME, 516-399-1877. Web: <http://www.li.net/~n2mdq>
OH - VAN WERT - Hamfest. County Fairgrounds, US 127 S. Louie Thomas WD8LLO, 419-238-2812. E-Mail: barnesrl@bright.net
Web: <http://www.bright.net/~barnesrl/w8fy.htm>

JULY 24-25
FL - MILTON - Milton ARC Hamfest. Mark McAnally KE4QKN, 850-626-7686. E-Mail: KE4QKN@AOL.COM
OK - OKLAHOMA CITY - OK State Convention. Harold Miller KB1ZQ, 405-672-7735. E-Mail: n11pn@swbell.net

JULY 24-25-26
AZ - FLAGSTAFF - AZ State Convention. Mark Kesauer N7KKQ, 602-440-2039. E-Mail: arcathill@aol.com
MI - TAYLOR - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 734-287-2000

JULY 25
IN - HUNTINGTON - Huntington Co. ARC Hamfest. Ray Tackett 219-786-0029. E-Mail: rtackett@huntington.in.us
NC - ASHEVILLE - Hamfest. Haywood Co. Fairgrounds. 8am-4pm. Thomas Queen K4BNP, 828-258-2639. E-Mail: k4bnp@aol.com
OH - CINCINNATI - OH-KY-IN ARS Hamfest. Dana Laurie WA8M, 513-761-7388. E-Mail: rdl@one.net

JULY 25-26
OK - OKLAHOMA CITY - Ham Holiday. OK State Fair Park (Hobbies, Arts & Crafts Bldg.) Sat: 5-8pm, Sun: 8am-5pm. Thomas Webb 405-732-7110. Web: www.geocities.com/heartland/7332. E-Mail: n11pn@swbell.net

JULY 26
CA - SANTA ANA - Swapmeet. ACP parking lot. Gary Russo 714-558-8813
IL - MARY ELLEN - Computer Show & Sale. College of DuPage. Main Arena of Phys Ed Bldg. Corner of Park Blvd. & College Rd. 9:30am-3pm. Computer Central Shows 847-940-7547
MD - TIMONUM - Hamfest. York Rd. Bob Koblisch N3HAT, 410-467-4634. E-Mail: n3hat@erols.com
Web: <http://www.smart.net/~brats>
ME - PORTLAND/WESTBROOK - Computer Show. Verrillo's Convention Center. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com
OH - PAULDING - Hamfest. Park Lane Center, Fairgrounds Rd. Jerry KB8MAF, 419-399-4507. E-Mail: JLRHOD@BRIGHT.NET

JULY 31-AUGUST 1
TX - AUSTIN - State Convention. Joe Makeever W5HS, 512-345-0800

JULY 31-AUGUST 1-2
MI - MT. CLEMENS - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

AUGUST 1998

AUGUST 1
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
KY - BOWLING GREEN - KY Colonels ARC Hamfest. Leon Garrett K4CIT, 502-842-5307
MO - SPRINGFIELD - State Convention. Karen Thorpe NOTDW, 417-889-6775
NC - HIGH POINT - Hamfest. National Guard Armory, 8am-1pm. 336-887-3039. E-Mail: RAHam@infoave.net
NY - WEEDSPORT - Hamfest. Weedsport Speedway/Fairgrounds, Rt. 31. Joe Kahler WA2NGX, 315-364-5135
OH - COLUMBUS - Voice of Aladdin ARC Hamfest. Jim Morton KB8KPJ, 614-846-7790
OR - BASTON - Coos Co. RC Hamfest. Brian Howard W7MLT, 541-572-5623

AUGUST 1-2
FL - JACKSONVILLE - Hamfest & Computer Show. Prime Osborn Convention Ctr. Sat: 9am-5pm, Sun: 9am-3pm. 904-268-2302. Web: <http://www.pobox.com/~w4ue/hamfest.html>

AUGUST 2
IL - PEOTONE - Hamfest. Dave Brasel NF9N, 708-448-0580
IN - ANGOLA - Land of Lakes ARC Hamfest. Theresa J. Limestahl KB9NNR, 219-495-5403. E-Mail: tjlimestahl@dmci.net
NH - PORTSMOUTH - Computer Show. Yoken's. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com
OH - RANDOLPH - ARC Hamfair. Portage County Fairgrounds, St. Rt. 44. 8am-4pm. Joanne Solak KJ30, 330-274-8240
VA - BERRYVILLE - Hamfest & Computer Show. Clarke Co. Ruritan Fairgrounds. Tom Martin KF4TNX, 540-539-4301. E-Mail: hamfest@vvalley.com
Web: <http://www.vvalley.com/svarc.hamfest>

AUGUST 8
CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
IL - QUINCY - Western IL ARC Hamfest. Jim Funk N9JF, 217-336-4191. E-Mail: jfunk@adams.net Web: <http://scribers.midwest.net/bcrocknet/swapfest.htm>
WV - HUNTINGTON - Tri-State ARA Hamfest. Bernard Mays WB8ZER, 304-743-5459. E-Mail: wb8zer@juno.com

AUGUST 9
IA - AMANA - Cedar Valley ARC Hamfest. Wayne Kolosik KI0FE, 319-393-4224. E-Mail: ki0fe@usa.net
KY - FRANKFORT - Hamfest. Western Hills High School. John R. Barnes KS4GL, 606-253-1178 eves. E-Mail: ks4gl@juno.com
NH - MANCHESTER - Computer Show. Holiday Inn Expo Center. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

AUGUST 14-15
LA - NEW ORLEANS - Int'l DX Convention. Don Boudreau W5FXK, 504-737-9733

AUGUST 14-15-16
CA - SAN DIEGO - ARRL Southwestern Division Convention. Town & Country Hotel, Mission Ballroom, 500 Hotel Cir. N. Cybil Allbright 619-278-4284

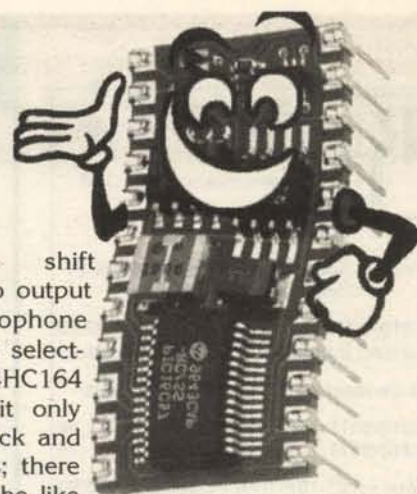
AUGUST 15
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
GA - ALBANY - Computer & Elect. Expo. Hasan Temple, 1822 Palmyra Rd. 9am-5pm. Sandy Rabb 912-888-9393. E-Mail: GODS@SURFSOUTH.COM
KS - CHANUTE - Chanute Area ARC Hamfest. Charlie Ward WD0AKU, 316-431-6402
NH - SEABROOK - Computer Show. Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

AUGUST 15-16
AL - HUNTSVILLE - Hamfest. Von Braun Civic Ctr. Sat: 9am-4:30pm, Sun: 9am-2:30pm. Art Davis WB4KKA, 256-883-0477
Web: www.hamfest.org
MN - WASECA - Hamfest & Craftfair. Waseca Co. Fairgrounds. Lloyd L. Schlaak 507-465-8619. E-Mail: n0vfv@smig.net

AUGUST 16
IN - LAFAYETTE - Tippecanoe ARA Hamfest. James Canarecci WA9TGO, 765-474-6570
KS - SALINA - Central KS ARC Hamfest. Ron Tremblay WA0PSF, 785-827-8149. E-Mail: tremblay@midusa.net

STAMP APPLICATIONS

by Jon Williams



Putting the Spotlight on BASIC Stamp Projects, Hints, and Tips

Talk Is Cheap!

As far as output devices go, LEDs are okay, character LCDs are nice, and graphical LCDs are pretty cool. But a voice? Now you're talking — literally. With a couple of chips, a little time with your soldering iron, and just a bit of code, you can give your BASIC Stamp projects a voice and an unlimited English vocabulary to go along with it.

The SP0256-AL2

The heart of this project is the General Instrument SP0256-AL2 allophone speech processor. I'm sure that somebody will question the logic of doing a project with a chip that went out of production quite some time ago, especially when there are other devices available. I went with the SP0256-AL2 because they're still easy to come by (from B.G. Micro; see Sources), they're inexpensive, they're easy to interface, and I like

the idea of the unlimited (English) vocabulary.

Being a simple guy, I'm going to keep things simple (if you want the gory technical details, you can read them in the GI docs). The SP0256-AL2 is a specialized processor that contains 64 digitally-encoded speech sounds — called allophones — and the software to convert the digital allophone data to an audible sound. By linking allophones, we can create speech.

Selecting an allophone is a simple matter of placing its address on the SP0256-AL2 bus and strobing (high to low) the ALD line. If the address buffer is full, the LRQ line will go high, so we should check it before loading another allophone address.

Making The Connection

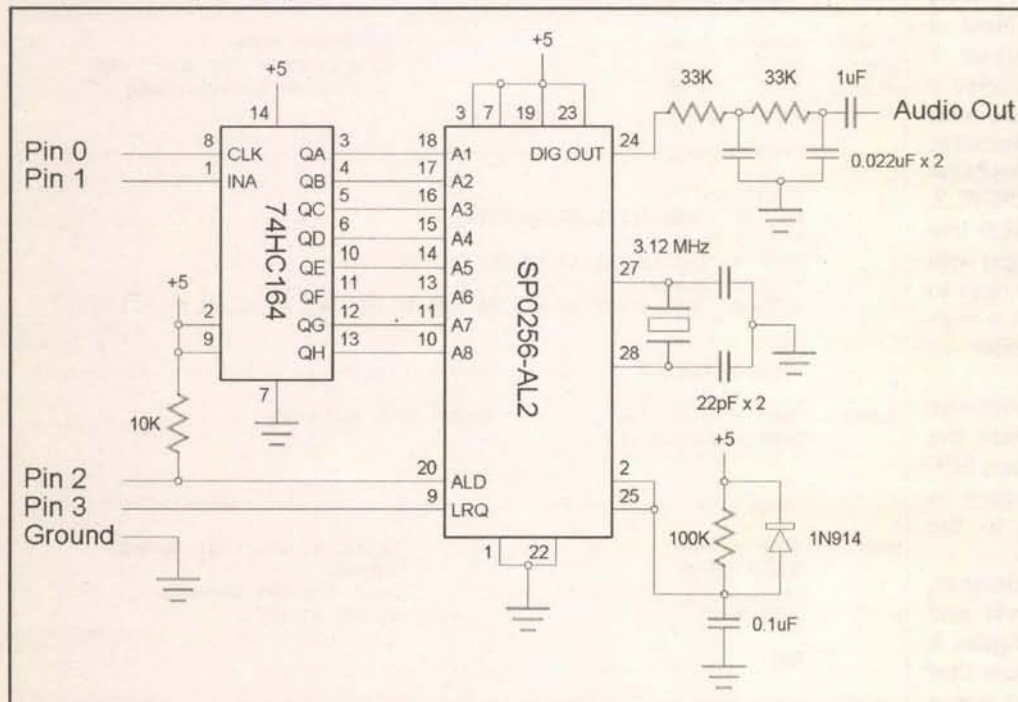
To make a straightforward connection to the SP0256-AL2, we need eight lines: six for the allophone address, and one each for ALD and LRQ. You could, of course, connect direct, but this chews up a lot of pins and leaves nothing left if

74HC164 shift register to output the allophone address. I selected the 74HC164 because it only needs clock and data lines; there is no strobe like on the 75HC595. What this means, however, is that the outputs ripple with the clock. This presents no problem for our project since the SP0256-AL2 address lines are ignored until ALD is pulsed low.

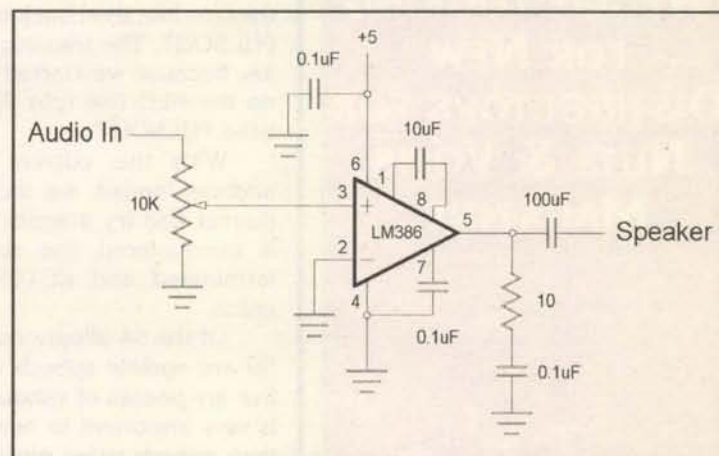
Figure 1 shows the schematic for the circuit. You'll notice that I used all of the address lines on the SP0256-AL2. Technically, I could have tied A7 and A8 to ground, but I figured it was just as easy to connect them to the 74HC164. This also makes my circuit compatible with the SP0256, provided I connect an external speech ROM to the appropriate pins on the SP0256.

I also elected to use an external amplifier. If you'd like to have an onboard audio amp, Figure 2 shows an appropriate circuit. Just keep your wiring tight around the op-amp to prevent it from oscillating.

Wiring up the circuit will be the most time-consuming task of this project. There are really too many connections to try to put this on a solderless breadboard, so point-to-point wiring (my choice) or wire-wrapping is called for. Of course, if you have the tools and know-how to make your own PC boards, that would be even nicer. Take your time. You certainly don't want to screw



you're using a BS1. I cut the pin count down to four by using a



Miniature Transmitters and Receivers



RF300T
RF300XT



- ☐ 2 Button - 3 Channel Remote Control Transmitter
- ☐ 59,049 Changeable Security Codes - 10 Trinary Bits
- ☐ Operates at 318mhz
- ☐ 12 Volt Battery Incl.
- ☐ Size - 1.25" x 2"
- ☐ 1 Inch Keyring

	Qty	1	5	10
150' Range 2 Button Transmitter		24.95	20.95	16.95
300' Range 2 Button Transmitter		29.95	24.95	20.95

- ☐ 3 Channel Remote Control Receiver
- ☐ Input : 8-12vdc regulated or 11-24vdc unregulated
- ☐ Latched or Momentary Digital Outputs (x: L or M)
- ☐ PCB Board Size - 1.25" x 3.75"

RF300Rx	3 Channel Receiver	24.95	20.95	16.95
RF300RKx	3 Channel Receiver Kit	19.95	15.95	12.95

Visitect Inc. 510-651-1425

P.O. Box 14156 Fremont CA 94539 Fax 510-651-8454 Accept Visa, M/C, COD's

Write in 49 on Reader Service Card.

CABLE TV BOXES MULTISYSTEM

"BUY ONE, GET ONE HALF PRICE"

1. Replacement for all systems.
2. No makes and models required.
3. Built-in copy guard, sleep timer.
4. Volume and remote control, P.G.

1-800-807-6543

30 day money back guarantee and 6 month warranty

Write in 50 on Reader Service Card.

Nuts & Volts Magazine/June 1998 23

STAMP APPLICATIONS



The RF Connection
213 North Frederick Ave.
Suite 11NV
Gaithersburg, MD USA
20877

<http://www.therfc.com/>

Complete Selection of MIL-Spec Coax, RF
Connectors and Relays

UG-21B/U N Male for RG-213/214.....\$5.00
UG-21D/U N Male for RG-213/214.....\$3.25

N Connectors for 9913/Flexi4XL/9096

UG-21B/9913.....\$6.00 Pins Only.....\$1.50
UG-21D/9913.....\$4.00 Extra Gasket......75

Amphenol 83-1SP-1050 PL-259.....\$0.90
UG-176/U Reducer RG-59/8X .25 or 5/\$1.00
UG-175/U Reducer RG-58/58A .25 or 5/\$1.00
Silver Teflon PL-259/Gold Pin.....
.....\$1.00 or 10/\$9.00

MIL-Spec Coax Available (Teflon, PVC IIA)

New Product: Belden 9913F. 9913 with
High Density PE Foam dielectric, stranded
center cond. and Duobond III Jacket.....
.....80/ft or \$76.00/100ft
Also New: 9092, RG8X with Type II Jacket
Intro Price.....\$23.00/100ft
Call for Specials of the Month

Full Line of Audio Connectors for Icom,
Kenwood, and Yaesu

8 Pin Mike Female.....\$2.50
8 Pin Mike Male Panel.....\$2.50
13 Pin DIN for Kenwood.....\$2.75
8 Pin DIN for Icom.....\$1.00
8 Pin DIN for Kenwood.....\$1.50

Prices Do Not Include Shipping

Orders 800/783-2666
Info 301/840-5477
FAX 301/869-3680

Write in 51 on Reader Service Card.

WE ARE LOOKING FOR NEW DISTRIBUTORS FOR NUTS & VOLTS MAGAZINE.

If you are interested
in selling Nuts &
Volts in your store
or on your news-
stand, we have a
great deal for you!

FOR COMPLETE
INFORMATION, ASK FOR
OUR NEW DISTRIBUTOR
FLYER.

Nuts & Volts Magazine

430 Princeland Court
Corona, CA 91719

phone 909-371-8497

fax 909-371-3052

E-Mail

distributors@nutsvolts.com

things up by rushing through your wiring. You'll be rewarded for your patience.

The Software

BASIC Stamp software really doesn't get any easier than this, folks. After last month (remember the graphing thermometer and all the trouble I had squeezing it into the BS1?), this one's a breeze. Please refer to Listing 1 for analysis.

My strategy goes like this: I store speech strings in the Stamp's EEPROM. Each string ends with the marker byte \$FF. To say a particular string, I load its EEPROM address into the variable called addr and call the subroutine called Speak. Nothing to it.

Speak reads the data stored at the current value of addr. If it is not \$FF (the end of the speech marker), we send it to the SP0256-AL2. But first we have to make sure that the SP0256-AL2 address buffer is not full. If it is, we wait for the LRQ line to go low.

When the speech processor is ready, we output an allophone address via the 74HC164 (Most of you have seen this code before. If you're new, or haven't connected a BS1 to a shift register, please refer to the section titled "Shifty Business For Beginners.") With the allophone address placed on the SP0256-AL2, we load it by pulsing the ALD line (high to low, then back to high) with PULSOUT. The transition is high to low because we started with a high on the ALD line (pin 2) before we used PULSOUT.

With the current allophone address loaded, we increment the pointer and try it again. When \$FF is encountered, the subroutine is terminated and RETURNs to the caller.

Of the 64 allophone addresses, 59 are audible speech sounds and five are pauses of various lengths. It is very important to remember that your speech string must end with a pause. Otherwise, the last allophone will continue to play.

As always, I've made heavy use of SYMBOLs to make the code more readable. This includes all of the allophones. There is one allophone — OR — that collides with a PBASIC keyword. The problem is solved with the addition of an underscore. You'll see "_OR" in the allophone table (Listing 2).

Talk, Talk, Talk

Once you're all wired up, the fun begins: creating speech data. This is not quite as easy as it might seem, because there is no direct correlation between the spelling of a given word and the allophones used to produce it. Things get even

Listing 1
Nuts & Volts: Stamp Applications, June 1998

```

'-----[ Title ]-----
'
' File..... TALKER.BAS
' Purpose... BASIC Stamp -> SP0256-AL2 Allophone Speech Processor
' Author.... Jon Williams
' E-mail.... jonwms@aol.com
' WWW..... http://members.aol.com/jonwms
' Started... 03 MAY 98
' Updated... 03 MAY 98

'-----[ Program Description ]-----
'
' This program enables the BASIC Stamp to talk by interfacing with the GI
' SP0256-AL2 Allophone Speech Processor.

' A 74HC164 parallel output shift register is used to provide the allophone
' address to the SP0256-AL2. Four I/O lines are used:

' Pin 0 (Out)  Clock to 74HC164 (can be shared)
' Pin 1 (Out)  Data to 74HC164 (can be shared)
' Pin 2 (Out)  ALD - pulsed low causes allophone address to be loaded
' Pin 3 (In)   LRQ - goes high when the SP0256-AL2 address buffer is full

'-----[ Revision History ]-----
'
' 03 MAY 98 : Version 1

'-----[ Constants ]-----
'
SYMBOL Clk      = 0
SYMBOL Dio      = Pin1
SYMBOL ALD      = 2
SYMBOL LRQ      = Pin3
' Address Load
' Load Request

' Copy and Paste "ALLOPHON.BAS" here

'-----[ Variables ]-----
'
SYMBOL data      = B0
SYMBOL shift     = B2
SYMBOL addr      = B3
' allophone data
' loop counter for shift out
' EE address of allophone

'-----[ EEPROM Data ]-----
'
' Hello,
EEPROM (HH1,EH,LL,AX,OW,PA4)
' I am the
EEPROM (AA,AY,PA2,AE,MM,PA2,DH1,AX,PA2)
' BASIC Stamp
EEPROM (BB2,EY,SS,IH,KK2,PA3,SS,SS,PA1,TT2,AE,AE,MM,PP,PA1,$FF)

'-----[ Initialization ]-----
'
Init:  Pins = %00000100      ' begin with ALD high
      Dirs = %00000111

'-----[ Main Code ]-----
'
Main:  addr = $00
      GOSUB Speak
      PAUSE 2000
      GOTO Main
      END

'-----[ Subroutines ]-----
'
Speak: READ addr, data
      IF data = $FF THEN Done
      IF LRQ = 1 THEN Busy
      FOR shift = 1 TO 8
        Dio = Bit7
        PULSOUT Clk, 10
        data = data * 2
      NEXT
      PULSOUT ALD, 10
      addr = addr + 1
      GOTO Speak
Done:  RETURN

' get allophone from EE table
' if $FF, we're done
' wait if SP0256-AL2 buffer full
' shift out the allophone address
' get a bit
' clock it out
' left-shift the byte

' load the allophone
' point to next allophone address

```

trickier when one considers that the same allophone can have a bit of a different sound based on its position in the word. It won't take too long to get the hang of concatenating allophones to create speech. What I found is that I started listening very carefully to the way I say words. Diphthongs (vowel sounds

that glide together) are the trickiest part of the encoding. And don't worry, you don't have to figure everything out from scratch.

Please download TALKER.ZIP from my FTP directory. Along with the source code for this project, you'll find a couple of PDF documents that I located on the Internet.

STAMP APPLICATIONS

' Listing 2

' Nuts & Volts: Stamp Applications, June 1998

' Allophone constants for "TALKER.BAS"

SYMBOL	PA1	= \$00	' 10 ms pause (before BB, DD, GG and JH)
SYMBOL	PA2	= \$01	' 30 ms pause (before BB, DD, GG and JH)
SYMBOL	PA3	= \$02	' 50 ms pause (before PP, TT, KK and CH) (and between words)
SYMBOL	PA4	= \$03	' 100 ms pause (between clauses and sentences)
SYMBOL	PA5	= \$04	' 200 ms pause (between clauses and sentences)
			' sample word
SYMBOL	OY	= \$05	' bOY
SYMBOL	AY	= \$06	' skY
SYMBOL	EH	= \$07	' End
SYMBOL	KK3	= \$08	' Comb
SYMBOL	PP	= \$09	' Pow
SYMBOL	JH	= \$0A	' doDGe
SYMBOL	NN1	= \$0B	' thiN
SYMBOL	IH	= \$0C	' sIt
SYMBOL	TT2	= \$0D	' To
SYMBOL	RR1	= \$0E	' Rural
SYMBOL	AX	= \$0F	' sUcceed
SYMBOL	MM	= \$10	' Milk
SYMBOL	TT1	= \$11	' parT
SYMBOL	DH1	= \$12	' THey
SYMBOL	IY	= \$13	' sEE
SYMBOL	EY	= \$14	' bEige
SYMBOL	DD1	= \$15	' couLD
SYMBOL	UW1	= \$16	' tO
SYMBOL	AO	= \$17	' AUght
SYMBOL	AA	= \$18	' hOt
SYMBOL	YY2	= \$19	' Yes
SYMBOL	AE	= \$1A	' hAt
SYMBOL	HH1	= \$1B	' He
SYMBOL	BB1	= \$1C	' Business
SYMBOL	TH	= \$1D	' THin
SYMBOL	UH	= \$1E	' bOOK
SYMBOL	UW2	= \$1F	' food
SYMBOL	AW	= \$20	' Out
SYMBOL	DD2	= \$21	' Do
SYMBOL	GG3	= \$22	' wiG
SYMBOL	VV	= \$23	' Vest
SYMBOL	GG1	= \$24	' Got
SYMBOL	SH	= \$25	' SHip
SYMBOL	ZH	= \$26	' aZure
SYMBOL	RR2	= \$27	' bRain
SYMBOL	FF	= \$28	' Food
SYMBOL	KK2	= \$29	' sKy
SYMBOL	KK1	= \$2A	' Can't
SYMBOL	ZZ	= \$2B	' Zoo
SYMBOL	NG	= \$2C	' aNchor
SYMBOL	LL	= \$2D	' Lake
SYMBOL	WW	= \$2E	' Wool
SYMBOL	XR	= \$2F	' repair
SYMBOL	WH	= \$30	' WHig
SYMBOL	YY1	= \$31	' Yes
SYMBOL	CH	= \$32	' CHurCH
SYMBOL	ER1	= \$33	' fIR
SYMBOL	ER2	= \$34	' fIR
SYMBOL	OW	= \$35	' bEAU
SYMBOL	DH2	= \$36	' THey
SYMBOL	SS	= \$37	' veSt
SYMBOL	NN2	= \$38	' No
SYMBOL	HH2	= \$39	' Hoe
SYMBOL	_OR	= \$3A	' stORe (note leading underscore)
SYMBOL	AR	= \$3B	' alARm
SYMBOL	YR	= \$3C	' cleaR
SYMBOL	GG2	= \$3D	' Guest
SYMBOL	EL	= \$3E	' saddLE
SYMBOL	BB2	= \$3F	' Business

' end of Allophone table

Both are scans of SP0256-AL2 documentation. One is from GI, the other from Radio Shack. The Radio Shack document contains a lot of application information — good stuff that you'll find extremely helpful when you start working with the SP0256-AL2. There's information about the chip and how it works, as well as a nice library of common words, numbers, names of months, and the days of the week.

Applications

If you consider that we proba-

bly get most of our information through spoken words, the applications for this technology are limitless. Here are a couple of ideas that come to mind: a talking thermometer (I told you I had a thing for thermometers!), a talking clock, a talking alarm system, and various devices for the blind. Heck, you could even make your own annoying "Your door is ajar ..." alarm for the family automobile. Another obvious application is giving your Stamp-controlled pet robot a voice.

Have fun. If there's enough interest in this and other voice-ori-

Shifty Business For Beginners

Since the Stamp does not use a traditional address/data bus, beginners are often troubled with I/O expansion, especially with the BS1. Upon analysis, we'll find that we usually define pins as inputs or outputs, and rarely do we need to change the state of a pin mid-program. Since this is the case, we can expand our Stamp I/O with shift registers.

This project uses the 74HC164 serial-in, parallel-out shift register. With the 74HC164, we can turn two Stamp lines into eight. What we've effectively done is expanded the Stamp's outputs from eight to 14 (remember that two are used to control the shift register). If you need more outputs, you can use the 74HC595 because it's cascadable (you can link two or more together in a chain). Be aware that the '595 also requires a strobe line to transfer your data to the outputs. If your circuit requires more than eight (additional) outputs, or you don't want the outputs to ripple (change) with the clock line, the 74HC595 is the way to go.

For the sake of discussion, let's stick with the '164. When the clock line is pulsed high, the state of the input pin (high or low) is transferred to output A. At the same time, what was on output A is transferred to output B, and so on down the line. The content of output H, the last bit, is transferred into bit-oblivion — it's gone forever. By doing eight such transfers, we can output an eight-bit byte with two pins.

Back in August, I made the comment that it is my habit to reserve variables B0 and B1 for bit-level access. Here's where we'll use bit-level access.

Take a look at the FOR-NEXT loop embedded in the Speak subroutine. This loop runs eight times; enough to shift out a byte. The first thing we do is grab Bit7 and output it to the data pin. Bit7 is the MSB (most significant bit) of B0, the variable that holds our shifted data (it is SYMBOLically renamed data). We grab Bit7 because we want this bit to be present on 74HC164 output H when we're done with eight clock pulses.

After Bit7 is output, we want to do the same thing with Bit6, then Bit5, and so on, down to Bit0. We could do this in hard code, but that technique would be wasteful. It's more convenient to move Bit6 to Bit7 and repeat the same set of code. We call this a left shift since the bit values move to their left during this process. Since we're dealing with binary numbers, multiplying the current value of data by two causes a left shift. It's important to keep in mind that the value of data will change during this subroutine. If you need to save it for some reason, make a copy to another variable before calling Speak.

Okay, what about inputs? Not a problem. Go get a 74HC165: a parallel-input, serial output shift register. This chip complements the '164. With the ground we've just covered, you should be able to check out the specs and put together the code, so I will not deny you the opportunity to learn from the experience. I will, however, give you a hint. In order to share the data line with the '164, you'll need to change it from an output to input and back. For an example, take a look at last month's project — it used this technique.

ented projects, we'll put one together with one of the newer options. The call is yours. My E-Mail address is in the Sources section. Happy Stamping. **NV**

SOURCES

For more information on the BASIC Stamp, contact:

Parallax, Inc.

3805 Atherton Road, #102

Rocklin, CA 95765

phone (916) 624-8333

Internet

<http://www.parallaxinc.com>

Scott Edwards Electronics, Inc.

2700 E. Fry Blvd. Suite A4

Sierra Vista, AZ 85635

phone 520-459-4802

fax 520-459-0623

www.seetron.com

info@seetron.com

B.G. Micro

P.O. Box 280298

Dallas, TX 75228

Orders: 800-276-2206

<http://www.bgmicro.com>

Jon Williams

1505 Grande Blvd., #1602

Tyler, TX 75703

(903) 509-1691

jonwms@aol.com

Internet:

<http://members.aol.com/jonwms>

<ftp://members.aol.com/jonwms/stamps>



WE BUY AND SELL

Inquiries 303-438-9662 • Fax 303-438-9685

Orders only 800-538-1493

530 Compton St., Unit #C, Broomfield, Colorado 80020

OSCILLOSCOPES & ACCESSORIES

TO 100 MHz

TEK 7A22 1 MHz High CMRR Differential Amplifier	\$300.00
TEK 7B53A 100 MHz Dual Time Base	\$175.00
TEK SC502 15 MHz Dual Trace Oscilloscope, TM500 series	\$375.00

ABOVE 100 MHz

TEK 2465 300 MHz 4-channel Oscilloscope	\$2,500.00
TEK 7104 1 GHz Oscilloscope, with 7A29, 7A29-04, 7B10, 7B15	\$4,500.00
TEK 7844 400 MHz Dual Beam Oscilloscope frame	\$600.00
TEK 7844 400 MHz Dual Beam Oscilloscope, with 7A24, 7A26, 7B80, 7B85	\$1,000.00
TEK 7904A 500 MHz System, with 7A24, 7A26, 7B80, 7B85	\$1,250.00
TEK 7A13 105 MHz Differential Comparator	\$225.00
TEK 7A19 600 MHz Single Trace Amplifier	\$150.00
TEK 7A24 400 MHz Dual Trace Amplifier	\$300.00
TEK 7A26 200 MHz Dual Trace Amplifier	\$175.00
TEK 7B15 1 GHz Delaying Time Base	\$450.00
TEK 7B80 400 MHz Delayed Time Base	\$175.00
TEK 7B85 400 MHz Delta Delaying Time Base	\$175.00
TEK 7B92A 500 MHz Dual Time Base	\$275.00

STORAGE

TEK 7633 100 MHz Storage Oscilloscope frame	\$600.00
TEK 7633 100 MHz Storage Oscilloscope, with (2) 7A26, (1) 7B92A	\$900.00

PROBES

HP 1122A Probe Power Supply	\$200.00
TEK 1101 Accessory Power Supply, for FET probes	\$250.00
TEK P6046 100 MHz Differential Probe	\$750.00
TEK P6201 900 MHz 1X/10X/100X FET Probe	\$450.00
TEK P6202A 500 MHz 10X FET Probe	\$300.00
TEK P6701-opt.02 O/E Converter, 450-1050 nm/0-1 mW: DC-700 MHz, ST conn.	\$675.00

CALIBRATION

TEK 067-0587-01 Signal Standardizer, Calibration Fixture, 7000 series	\$300.00
TEK CG5001-opt.01/TM5006 Programmable Oscilloscope Calibrator, with power module	\$6,000.00
TEK SG503 Level Generator, 250 kHz-250 MHz, TM500 series	\$600.00

WAVEFORM GENERATORS

FUNCTION

HP 3310A 5 MHz Function Generator	\$250.00
HP 3310B 5 MHz Function Generator, monocyclus & var.phase trigger	\$325.00
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's	\$275.00
TEK FG501 1 MHz Function Generator, TM500 series	\$225.00
TEK FG503 3 MHz Function Generator, TM500 series	\$250.00
TEK RG501 Ramp Generator, TM500 series	\$225.00

PULSE

BERKELEY NUCLEONICS 7085B Digital Delay Generator, 0-100 mS, 1 nS res., 5 Hz-5 MHz	\$900.00
HP 214B-001 10 MHz Pulse Generator, 50 V/50 ohms, counted burst opt	\$1,750.00
HP 8005B 20 MHz Dual Output Pulse Generator	\$400.00
HP 8007B 100 MHz Pulse Generator	\$650.00
HP 8012B 50 MHz Pulse Generator, variable transition time	\$600.00
HP 8015A 50 MHz Dual Output Pulse Generator	\$750.00
HP 8080A/81A/83A/84A 300 MHz Word Generator	\$800.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator	\$950.00

TEK PG502 250 MHz Pulse Generator, Tr<1nS, TM500 series	\$600.00
TEK PG505 100 kHz Pulse Generator, 80 V peak, TM500 series	\$275.00

PROGRAMMABLE

HP 3325A 21 MHz Synthesized Function Generator, GPIB	\$1,650.00
HP 3325A-002 Synthesized Function Generator, High Voltage Output opt	\$1,750.00
HP 8161A-020 100 MHz Programmable Pulse Generator, dual channel opt.	\$3,500.00
HP 8165A-002,003 Prog. Signal Source, 1 mHz-50 MHz, log sweep, rear out	\$2,000.00
TEK AWG5102 Arb.Waveform Gen., 20 MS/s, 12 bits, 50ppm synthesis <1MHz	\$1,400.00
TEK AWG5105-opt.02 Arbitrary Waveform Generator, dual channel option	\$1,900.00
WAVETEK 288 20 MHz Synthesized Function Generator, GPIB	\$1,000.00

VOLTAGE & CURRENT

VOLTMETERS

HIPOTRONICS KVM200D 3-1/2 digit DVM / HV Divider, 0-200 kV, 2000:1 division	\$1,000.00
HP 3456A 6-1/2 Digit Voltmeter	\$750.00
HP 3468A 5-1/2 digit Multimeter	\$300.00
HP 3478A 5-1/2 digit Multimeter, GPIB	\$700.00
KEITHLEY 181 6-1/2 digit Nanovoltmeter, 10 nV sensitivity, GPIB	\$1,000.00
SOLARTRON 7081 8-1/2 digit Voltmeter	\$3,900.00
TEK DM501A 4-1/2 digit Multimeter, TM500 series plug-in	\$225.00

CALIBRATION

FLUKE 5100B-03.05 Calibrator, wideband AC & GPIB options	\$3,500.00
--	------------

FLUKE 510A AC Reference Standard, 10 VRMS, 0-10 mA	\$450.00
FLUKE 515A Portable Calibrator, DC/AC/Ohms, line & battery power	\$1,000.00
FLUKE 5220A Transconductance Amplifier, DC-5 kHz, 0-20 A	\$3,000.00
FLUKE 720A 7-decade Kelvin-Varley Voltage Divider	\$1,250.00
FLUKE 731B DC Reference Standard	\$400.00
FLUKE 732A DC Voltage Standard	\$2,000.00
FLUKE A55-series AC Thermal Converters	\$300.00
HOLT 11 AC Thermal Converter Set, 0.5-1200 V, 20 Hz-30 MHz	\$3,000.00
VALHALLA 2703 AC Volt.Std., 0-120V/10 Hz-100 kHz; 120-1200V/10 Hz-1 kHz	\$2,250.00

VOLTAGE SOURCES

HP 6114A Precision Dual Range Power Supply, 25V 2A / 40V 1A	\$850.00
HP 6115A Precision Dual Range Power Supply, 50V 0.8A / 100V 0.4A	\$850.00

CURRENT METERS & SOURCES

HP 4140B Picoammeter / DC Voltage Source, without 16055A fixture	\$2,500.00
HP 6177C DC Current Source, to 50V, 500mA	\$500.00
HP 6181C DC Current Source, to 100 V, 250 mA	\$500.00
HP 6186C DC Current Source, to 300V, 100mA	\$750.00
KEITHLEY 225 Current Source, 0.1 uA-100 mA, 10-100 V compliance	\$500.00
KEITHLEY 227 Current Source, 1 uA-1 A, 0-50 V compliance	\$800.00
KEITHLEY 228 Programmable Voltage/Current Source	\$2,500.00
KEITHLEY 261 Picoampere Source	\$375.00
KEITHLEY 614 Electrometer	\$800.00
KEITHLEY 642 Electrometer	\$2,900.00
TEK AM503/A6302/TM501 AC/DC Current Probe System	\$1,000.00
TEK CT-5 opt.05 High Current Transformer for P6021/A6302, to 1000A	\$500.00
VALHALLA 2301 Programmable Single Phase Power Analyzer	\$1,250.00
VALHALLA 2575A AC/DC Wideband Current Shunt, 20 mA-100 A, DC-10 kHz	\$950.00

IMPEDANCE & COMPONENT TEST

L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH	\$550.00
BOONTON 72B 1 MHz Capacitance Meter	\$600.00
ESI 2160 LCR Bridge, 20 Hz-150 kHz, GPIB	\$2,000.00
HP 4262A-101 3-1/2 digit LCR Meter, 120 Hz/ 1 kHz/ 10 kHz test, GPIB	\$2,250.00
HP 4275A-001 5-1/2 digit LCR Meter, 10 kHz-10 MHz, 0-35 V int. bias	\$6,000.00

STANDARDS

E.S.I. DB62-11K 6-Decade Resistor, 0-11,111.0 Ohms, 0.01 Ohm res.	\$300.00
E.S.I. SR1010 Resistance Transfer Standards, 1 Ohm-100 K/step	\$550.00
E.S.I. SR1050-1M Resistance Transfer Standard, 1 Megohm/step	\$2,000.00
E.S.I. SR1-set Set of eight Standard Resistors, 1 Ohm - 10 Megohms	\$900.00
GR 1404-A 1000 pF Reference Standard Capacitor	\$700.00
GR 1406 Standard Air Capacitors, GR900 connector, 0.1% acc.	\$375.00
GR 1412-BC Decade Capacitor, 50 pF - 1.11115 uF	\$350.00
GR 1432-U 4-Decade Resistor, 0-111.10 Ohms, 0.01 Ohm resolution	\$125.00
GR 1433-J 4-Decade Resistor, 0-1.110 Ohms, 1 Ohm resolution	\$350.00
GR 1433-N 5-Decade Resistor, 0-11.111 Ohms, 0.1 Ohm resolution	\$400.00
GR 1433-U 4-Decade Resistor, 0-111.0 Ohms, 0.01 Ohm resolution	\$350.00
GR 1433-X 6-Decade Resistor, to 111,111.0 Ohms, 0.1 Ohm res.	\$450.00
GR 1482-series Standard Inductors	\$275.00
VALHALLA 2724A Programmable Resistance Standard, 0-11 Gigaohms, GPIB	\$1,675.00

HI & LO RESISTANCE

GR 1666 DC Resistance Bridge, 1 Micro-Ohm - 100 Kiloohms	\$600.00
HP 4328A Milliohmeter	\$1,300.00
HP 4329A High Resistance Meter	\$1,200.00

CURVE TRACERS

TEK 577D1/177 Storage Curve Tracer, with standard test fixture	\$2,250.00
TEK 577D2/177 Curve Tracer, with standard test fixture	\$1,850.00

T.D.R.

TEK 1503-opt.04 Time Domain Reflectometer, 0-50,000 feet, chart recorder	\$1,400.00
--	------------

POWER SUPPLIES

SINGLE OUTPUT

HP 6200B Dual Range Supply, 0-20 V 0-1.5 A / 0-40 V 0-750 mA CVCC	\$200.00
HP 6201B 0-20 V 0-1.5 A CV/CC Power Supply	\$175.00
HP 6207B 0-180 V 0-200 mA CV/CC Power Supply	\$300.00
HP 6260B-027 0-10 V 0-100 A CV/CC Power Supply; 208 VAC line	\$675.00
HP 6261B-027 0-20 V 0-50 A CV/CC Power Supply; 208 VAC line	\$675.00
HP 6263B 0-20 V 0-10 A CV/CC Power Supply	\$400.00
HP 6266B 0-40 V 0-5 A CV/CC Power Supply	\$400.00

HP 6267B 0-40 V 0-10 A CV/CC Power Supply	\$550.00
HP 6269B-028 0-40 V 0-50 A CV/CC Power Supply; 230 VAC line	\$950.00
HP 6281A 0-7.5 V 0-5 A CV/CC Power Supply	\$175.00
HP 6284A 0-20 V 0-3 A CV/CC Power Supply	\$225.00
HP 6299A 0-100 V 0-750 mA CV/CC Power Supply	\$225.00
HP 6384A 4.0-5.5 V at 8 A CV/CL Power Supply	\$125.00
HP/HARRISON 6443B 0-120 V 0-2.5 A CV/CC Power Supply	\$375.00
KEPCO ATE 100-10M 0-100 V 0-10 A CV/CC Power Supply, 120 VAC 20 A line	\$900.00
KEPCO ATE 36-8M 0-36 V 0-8 A CV/CC Power Supply	\$375.00
SOERENSEN DCR 20-25B 0-20 V 0-25 A CV/CC Power Supply	\$550.00
SOERENSEN DCR 300-1.5B 0-300 V 0-1.5 A CV/CC Power Supply	\$600.00
SOERENSEN DCR 600-0.75B 0-600 V 0-750 mA CV/CC Power Supply	\$600.00
SOERENSEN SRL 20-12 0-20 V 0-12 A CV/CC Power Supply	\$400.00
SOERENSEN SRL 60-8 0-60 V 0-8 A CV/CC Power Supply	\$650.00
TEK PS501-1 Power Supply, 0-20 V, 2 mV res., 400 mA, TM500 series	\$175.00

MULTIPLE OUTPUT

HP 6205C Dual Power Supply, 0-40 V 300 mA / 0-20 V 600 mA, CV/CL	\$350.00
HP 6227B Dual 0-25 V 0-2 A CV/CC Power Supply	\$600.00
HP 6228B Dual 0-50 V 0-1 A CV/CC Power Supply	\$600.00
HP 6237B Triple Output Supply, +/- 0-20 V 0.5 A, 0-18 V 1 A	\$550.00
HP 6253A Dual Output 0-20 V 0-3 A CV/CC Power Supply	\$550.00
TEK PS5010 Programmable Triple Power Supply, TM5000 series	\$750.00
TEK PS503A Dual Power Supply, TM500 series	\$200.00

MISCELLANEOUS

ACME PS2L-500 Programmable Load, 0-75 V / 0-75 A / 500 Watts max.	\$400.00
HP 59501B HP/IB Isolated DAC/Power Supply Programmer	\$175.00
KEPCO BOP 50-2M/488 Bipolar Op Amp/Power Supply, to 50 V 2 A; GPIB	\$900.00
TRANSISTOR DEVICES DAL-50-15-100 Programmable Load, 0-50 V, 0-15 A, 100 Watts max.	\$200.00
TRANSISTOR DEVICES DVL-50-300-3000 Programmable Load, 0-60 V / 0-360 A / 3000 Watts max.	\$1,200.00

TIME & FREQUENCY

UNIVERSAL COUNTERS

FLUKE 1910A-02,03 125 MHz/ 500 nS Universal Counter, TCXO reference	\$175.00
HP 5315A 100 MHz/100 nS Universal Counter	\$450.00
HP 5315A-002,003 100 MHz/100 nS Univ. Counter, battery power, 1 GHz C-ch	\$650.00
HP 5315B 100 MHz/ 100 nS Universal Counter	\$500.00
HP 5316A 100 MHz/100 nS Universal Counter, GPIB	\$600.00
HP 5316B 100 MHz/ 100 nS Universal Counter, GPIB	\$1,000.00
HP 5334A 100 MHz Universal Counter, GPIB	\$850.00
HP 5334A-010,030,050 100 MHz Univ.Counter; OCXO, DVM, 1.3 GHz C-ch., rear in	\$1,000.00
HP 5334B-010,060 100 MHz Universal Counter, GPIB, OCXO	\$1,000.00
HP 5335A 200 MHz Universal / Statistical Counter	\$1,200.00
RACAL-DANA 1992-04 100 MHz/1 nS Univ. Counter, 1.3 GHz C-channel, OCXO	\$750.00
TEK DC5004 Programmable 100 MHz/100nS Counter/Timer, TM5000 series	\$250.00
TEK DC5009 Programmable 135 MHz Univ. Counter/Timer, TM5000 series	\$500.00
TEK DC5010 350 MHz / 3.125 nS Universal Counter, TM5000 series	\$1,200.00
TEK DC503A 125 MHz/ 100 nS Universal Counter, TM500 series	\$275.00

FREQUENCY COUNTERS

EIP 575 18 GHz Source Locking Counter, GPIB	\$2,500.00
EIP 578-opt.02,05 26.5 GHz Source Locking Counter; power meas., OCXO	\$5,000.00
HP 5340A 18 GHz Frequency Counter	\$1,200.00
HP 5342A 18 GHz Frequency Counter	\$2,400.00
HP 5342A-001 18 GHz Frequency Counter, OCXO reference	\$2,500.00
HP 5342A-003 18 GHz Freq.Counter, +22 dBm, -20 dBm dynamic range	\$2,400.00
HP 5342A-01,04,05 24 GHz Frequency Counter, OCXO, DAC	\$3,250.00
HP 5343A-001 26.5 GHz Frequency Counter, OCXO reference	\$4,500.00
HP 5345A/5355A/5356B 26.5 GHz CW/Pulse Frequency Counter	\$4,000.00
TEK DP501 1.3 GHz Prescaler, divide by 16, TM500 series	\$225.00

STANDARDS

HP 105A Quartz Oscillator, 0.1/ 1.0/ 5.0 MHz	\$750.00
HP 105B Quartz Oscillator, 0.1/ 1.0/ 5.0 MHz, battery power	\$1,500.00
HP 5087A-opt.033 Distribution Amplifier; 12 outputs at 10 MHz	\$1,750.00

AUDIO & BASEBAND

SPECTRUM ANALYSIS

HP 3586C Selective Level Meter, 50 Hz-32.5 MHz, 50 & 75 ohms	\$1,500.00
TEK 7L5/L3/R7603 Spectrum Analyzer, 20 Hz-5 MHz, 10 Hz min. res., w/frame	\$1,500.00



90 DAY WARRANTY PARTS AND LABOR • 10 DAY INSPECTION TEST EQUIPMENT WANTED CALL OR FAX LIST • OPEN ACCOUNTS



DISTORTION ANALYZERS

HP 333A Distortion Analyzer, 10 Hz-600 kHz	\$450.00
HP 339A Distortion Analyzer, built-in low distortion osc.	\$1,500.00
HP 8903A-001 Audio Analyzer, 20 Hz-100 kHz; rear panel input	\$2,600.00
HP 8903B-001, 013, 051 Audio Analyzer, 20 Hz-100 kHz; C-message, CCITT	\$3,750.00
TEK DA4084 Programmable Distortion Analyzer	\$1,000.00

RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, 180 uV-700 V, 10 Hz-20 MHz	\$500.00
FLUKE 8922A True RMS Voltmeter, 180 uV-700 V, 2 Hz-11 MHz	\$500.00

OSCILLATORS

HP 204C Oscillator, 5 Hz-1.2 MHz, 5 VRMS	\$150.00
HP 204D Oscillator, 5 Hz-1.2 MHz, 5 VRMS, 80 dB step attenuator	\$200.00
HP 209A Sine/Square Wave Generator, 4 Hz-2 MHz, 5 VRMS max.	\$225.00
TEK SG502 Sine/Square Osc., 5 Hz-500 kHz, 70 dB step atten., TM500	\$200.00

MISCELLANEOUS

HP 3575A-001 Phase-Gain Meter, 1 Hz-13 MHz, dual display option	\$850.00
HP 4437A Step Attenuator, 0-119.9 dB, DC-1 MHz, 600 ohms unbal.	\$175.00
HP 461A Amplifier, 20/40 dB, 1 kHz-150 MHz, 0.5 V/50 Ohms	\$125.00
KROHN-HITE 3103 High/Low Pass Filter, 10 Hz-3 MHz, 24 dB/octave	\$400.00
KROHN-HITE 3202R Dual HP/LP/BP/BR Filter, 20 Hz-2 MHz, 24 dB/octave	\$500.00
KROHN-HITE 3342R Dual HP/LP Filter, 0.001 Hz-99.9 kHz, 48 dB/octave	\$1,100.00
KROHN-HITE 3750 LP/HP/BP/BR Filter, 0.02 Hz-20 kHz, 6/12/18/24 dB/oct.	\$700.00
ROCKLAND 852 Dual Highpass/Lowpass Filter, 0.1 Hz-111 kHz	\$1,000.00
TEK AF501 Tunable Bandpass Filter / Amplifier, 3 Hz-35 kHz	\$300.00
TEK AM502 Differential Amplifier, 0.1 Hz-1 MHz, TM500 series	\$475.00

RF & MICROWAVE

SPECTRUM ANALYZERS

HP 11517A/18A/19A/20A Mixer Set, 12.4-40.0 GHz, for HP 8555A/8569A	\$600.00
HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz	\$1,100.00
HP 11970Q WR22 Harmonic Mixer, 33-50 GHz	\$1,400.00
HP 8444A-059 Tracking Generator, 0.5-1500 MHz, for 8554, 8568, etc.	\$1,250.00
HP 8445B Preselector, 1.8-18.0 GHz, for HP 8555A	\$650.00
HP 8565A-100 Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min. res.	\$4,500.00
HP 8566B Spectrum An., 100 Hz-22 GHz, HP calibration certificate	\$37,500.00
HP 8569B Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min.res.bw.	\$8,500.00
TEK 119-0098-00 WR42 Single Ended Mixer, 18.0-26.5 GHz, for Tek 491	\$200.00
TEK 119-0099-00 WR28 Single Ended Mixer, 26.5-40 GHz, for Tek 491	\$200.00
TEK 492-1.2.3 Spectrum Analyzer, 50 kHz-21 GHz, 100 Hz min. res.	\$6,500.00
TEK TR503 Tracking Generator, 0.1-1800 MHz, for 492/4/5/6	\$1,375.00
TEK WM490A WR28 Harmonic Mixer, 26.5-40 GHz	\$850.00
TEK WM782V WR15 Harmonic Mixer, 50-75 GHz	\$2,000.00

NETWORK ANALYZERS

HP 11665B Modulator, 0.15-18.0 GHz, N(m/f)	\$325.00
--	----------

SIGNAL GENERATORS

FLUKE 6060A Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res., GPIB	\$2,750.00
FLUKE 6060A/AN Synthesized Signal Gen., 10 kHz-520 MHz, 10 Hz res., GPIB	\$2,000.00
FLUKE 6062A Signal Generator, 0.1-2100 MHz, 10 Hz resolution	\$5,500.00
FLUKE 6070A Synthesized Signal Generator, 0.2-520 MHz, 1 Hz res.	\$2,000.00
GIGATRONICS 605/10-18 Synthesized Source, 10-18 GHz, 1 kHz res., GPIB	\$3,000.00
GIGATRONICS 605/2-8 Synthesized Signal Gen., 2-8 GHz, 1 kHz res., GPIB	\$3,000.00
GIGATRONICS 840-01 Freq. Doubler, 26.5-40 GHz (WR28) out, 13-20 GHz in	\$2,000.00
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm	\$3,500.00
GIGATRONICS 875/86 Levelled Multiplier, 26.5-40.0 & 50.0-75.0 GHz outputs	\$5,000.00
GIGATRONICS 910/12-18, opt6, 14, 16 Synthesized Source/Sweeper, 12-18 GHz, 1 Hz res., OCXO	\$3,500.00
HP 11720A Pulse Modulator, 2-18 GHz, 80 dB on/off ratio	\$750.00
HP 85100V Frequency Mult., 10-15 GHz in / 50-75 GHz out >0 dBm	\$4,250.00
HP 8640B-001, 002 Signal Gen., 0.5-1024 MHz, AM, FM, var. audio osc.	\$2,200.00
HP 8660C/86602B-002 Synth. Sig. Gen., 1-1300 MHz, FM / Phase mod. w/86635A	\$3,250.00
HP 8660C/86603A/86633B Synthesizer, 1-2600 MHz, AM, FM	\$3,750.00

SWEEP GENERATORS

HP 8350B/83502C-004 Sweep Oscillator, 10 MHz-20 GHz, +10 dBm levelled	\$18,500.00
HP 8600A Digital Marker, for HP 8601A	\$400.00
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled	\$400.00
HP 8620C Sweep Oscillator Frame	\$550.00
HP 8620C-011 Sweep Oscillator Frame, HP1B programmable	\$675.00
HP 86222A RF Plug-in, 10-2400 MHz, +13 dBm levelled	\$1,250.00

HP 86222B-002 RF Plug-in, 10-2400 MHz, +13 dBm levelled, 70 dB atten.	\$1,750.00
HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled	\$675.00
HP 86235A-001, 002 RF Plug-in, 1.7-4.3 GHz, +14 dBm levelled, 70 dB atten.	\$1,000.00
HP 86240C RF Plug-in, 3.6-8.6 GHz, +16 dBm levelled	\$1,000.00
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled	\$500.00
HP 86242D-004, 008 RF Plug-in, 5.9-9.0 GHz, +10 dBm levelled	\$500.00
HP 86245A RF Plug-in, 5.9-12.4 GHz, +16 dBm levelled	\$1,100.00
HP 86250D RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled	\$675.00
HP 86260A RF Plug-in, 12.0-18.0 GHz, +10 dBm unlevelled	\$800.00
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled	\$800.00
HP 86290A RF Plug-in, 2.0-18.0 GHz, +7 dBm levelled	\$1,750.00
HP 86290B RF Plug-in, 2.0-18.6 GHz, +10 dBm levelled	\$2,000.00
WAVETEK 2002A Sweep Generator, 1-2500 MHz, +13 dBm levelled	\$1,500.00
WAVETEK 962 Sweep Generator, 1.0-4.0 GHz, markers, +12 dBm unlvld.	\$1,500.00
WILTRON 6617A-40 Sweep Generator, 10 MHz-8 GHz, +16 dBm levelled	\$3,000.00

POWER METERS

ANRITSU MA72B Power Sensor, -20 to +20 dBm, 0.01-18 GHz	\$300.00
ANRITSU MP-81B/ML-83A Power Meter, 75-110 GHz (WR10), -20 to +20 dBm	\$2,500.00
BOONTON 4200-01A, 03/8-4A x2 Dual Channel Microwattmeter, w/(2) 1 MHz-7 GHz sensors	\$1,500.00
BOONTON 42B/41-4B Analog Power Meter, with 1 MHz-12 GHz sensor	\$375.00
BOONTON 42B/41-4E Analog Power Meter, with 1 MHz-18 GHz sensor	\$500.00
GENERAL MICROWAVE 476/4240A Power Meter & Sensor, 0.01-18 GHz, -35 to +10 dBm	\$300.00
HP 435A/8481A Power Meter, 10 MHz-18 GHz, -30 to +20 dBm	\$900.00
HP 435A/8482H Power Meter, 0.1-4200 MHz, -10 to +34 dBm	\$950.00
HP 435B-001/8482H Power Meter, 0.1-4200 MHz, AC or battery power	\$1,200.00
HP 8477A Power Meter Calibrator, for HP 432 series	\$500.00
HP Q8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435/6/7/8	\$1,500.00
HP R486A WR28 Thermistor Mount, 26.5-40 GHz, for 432 series	\$350.00

RF MILLIVOLTMETERS

RACAL 9303 TRMS Level Meter, 10 kHz-2 GHz, -77 to +23 dBm, GPIB	\$875.00
---	----------

AMPLIFIERS, MISCELLANEOUS

BOONTON 82AD-opt.01A Modulation Meter, AM, FM, 10-1200 MHz, GPIB	\$900.00
HP 11715A AM/FM Test Source	\$1,600.00
HP 415E SWR Meter	\$300.00
HP 465A Amplifier, 20/40 dB, 5 Hz-1 MHz, 1/2 Watt/50 Ohms	\$125.00
HP 8447A-001 Dual Amplifier, 0.1-400 MHz	\$450.00
HP 8447E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output	\$750.00
HP 8901A Modulation Analyzer, 150 kHz-1300 MHz	\$3,000.00
HP 8901B-1.2.3 Modulation An., 0.15-1300 MHz, rear input, OCXO, ext.LO	\$4,500.00
HP 8970A Noise Figure Meter	\$6,000.00
HUGHES 1177H01F000 TWT Amplifier, 2.0-4.0 GHz, 10 Watts output	\$1,500.00
HUGHES 1177H02F000 TWT Amplifier, 4.0-8.0 GHz, 10 Watts output	\$1,500.00
HUGHES 1277H02F000 TWT Amplifier, 4.0-8.0 GHz, 20 Watts output	\$2,500.00
HUGHES 802H02F000 TWT Amplifier, 4.0-8.0 GHz, 20 Watts output	\$2,750.00
MICROWAVE SEMI.CORP. MC5112 Noise Source, 25.5 dB ENR, 1.0-12.4 GHz, N(m), +28 VDC	\$275.00
ROHDE & SCHWARTZ ESH2 Test Receiver, 9 kHz-30 MHz	\$6,000.00

COAXIAL & WAVEGUIDE

AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna, LHC, 2-18 GHz, TNC(f) "NEW"	\$95.00
BIRD 8329-310 30 dB Attenuator, 2000 Watts, DC-1 GHz, LC(f)/N(f)	\$650.00
FXR/MICROLAB S3-02N Triple Stub Tuner, 200-1000 MHz, 100 Watts max., N(m/f)	\$125.00
GR 874-LTL Constant Impedance Trombone Line, 0-44 cm, DC-2 GHz	\$400.00
GR 900-Q GR900 14mm Interseries Adapters	\$125.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7	\$450.00
HP 11612A Bias Network, 45 MHz-26.5 GHz, APC3.5	\$550.00
HP 11691D Directional Coupler, 22 dB, 2-18 GHz	\$450.00
HP 774D Dual Directional Coupler, 20 dB, 215-450 MHz	\$275.00
HP 777D Dual Directional Coupler, 20 dB, 1.9-4.1 GHz	\$275.00
HP 8470B Crystal Detector, 10 MHz-18 GHz, neg. pol., APC7	\$250.00
HP 8472A Crystal Detector, 10 MHz-18 GHz, neg. pol., SMA	\$150.00
HP 8494G-002 Programmable Step Attenuator, Attenuator, 0-11 dB, DC-4 GHz, SMA	\$400.00
HP 8495G-002 Programmable Step Attenuator, 0-70 dB, DC-4 GHz, SMA	\$300.00
HP 8495H-002 Programmable Step Attenuator, 0-70 dB, DC-18 GHz, SMA	\$400.00
HP 8497K-004 Programmable Step Attenuator, 0-90 dB, DC-26.5 GHz	\$750.00
HP K422A WR42 Flat Broadband Detector, 18.0-26.5 GHz	\$350.00
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz	\$450.00
HP K870A WR42 Slide Screw Tuner, 18.0-26.5 GHz	\$275.00
HP K914B WR42 Moving Load, 18.0-26.5 GHz	\$350.00
HP Q752D WR22 Directional Coupler, 20 dB, 33-50 GHz	\$650.00
HP R375A WR28 Variable Attenuator, 0-20 dB, 26.5-40 GHz	\$375.00
HP R422A WR28 Flat Broadband Detector, 26.5-40 GHz	\$400.00
HP R532A WR28 Frequency Meter, 26.5-40 GHz	\$500.00
HP R752A WR28 Directional Coupler, 3 dB, 26.5-40 GHz	\$450.00
HP R914B WR28 Moving Load, 26.5-40 GHz	\$300.00
HP V365A WR15 Isolator, 25 dB, 50-75 GHz	\$900.00
HP V752D WR15 Directional Coupler, 20 dB, 50-75 GHz	\$650.00
HP X870A WR90 Slide Screw Tuner	\$150.00
HUGHES 4511H-2000 WR28 Isolator, 25 dB, 26.5-40 GHz	\$450.00

HUGHES 45712H-1000 WR22 Frequency Meter, 33-50 GHz	\$900.00
HUGHES 45721H-2000 WR28 Precision Rotary Vane Atten., 0-50 dB, 26.5-40 GHz	\$1,200.00
HUGHES 45732H-1200 WR22 Level Set Attenuator, 0-25 dB, 33-50 GHz	\$250.00
HUGHES 47316H-1111 WR10 Tuneable Detector, 75-110 GHz, positive polarity	\$600.00
HUGHES 47323H-1211 WR19 Flat Broadband Detector, negative, 40-60 GHz	\$650.00
HUGHES 47974H-1000 WR15 SPST PIN Switch, 250 MHz speed, 60-62 GHz response	\$375.00
KAY 442D Step Attenuator, 0-101 dB, 75 ohms, BNC	\$100.00
KRYTAR 1818 Directional Coupler, 16 dB, 2-18 GHz, SMA(f)	\$200.00
MA-COM 3-19-300/10 WR19 Directional Coupler, 10 dB, 40-60 GHz	\$450.00
MIDWEST MICROWAVE 3537 DC Block, 0.1-12.4 GHz, SMA(m/f) "NEW"	\$40.00
MINI-CIRCUITS ZFDC-20-4 Directional Coupler, 19.5 dB, 1-1000 MHz, SMA(f)	\$25.00
NARDA 25171 Level Set Attenuator, 0-17 dB, 2-8 GHz, SMA(f)	\$100.00
NARDA 26298 20 dB Attenuator, 150 Watts, DC-1 GHz, N(f/f)	\$200.00
NARDA 3000-SERIES Directional Couplers	\$150.00
NARDA 3024 Bi-Directional Coupler, 20 dB, 4-8 GHz	\$300.00
NARDA 3090-SERIES Precision High Directivity Couplers	\$225.00
NARDA 368NM Coaxial High Power Load, 500 Watts, 2.0-12.4 GHz, N(m)	\$400.00
NARDA 369BNF High Power Termination, 175 Watts, 0.7-18 GHz, N(f)	\$325.00
NARDA 3753B Coaxial Phase Shifter, 0-55 deg./GHz, 3.5-12.4 GHz	\$1,250.00
NARDA 4000-SERIES SMA Miniature Directional Couplers	\$75.00
NARDA 4203-6 Directional Coupler, 6 dB, 2-18 GHz, SMA(f/f)	\$225.00
NARDA 4245-10 Directional Coupler, 10 dB, 4-12 GHz, SMA(f)	\$100.00
NARDA 4799 Level Set Attenuator, 0-15 dB, 4-18 GHz, SMA(f)	\$135.00
NARDA 5070-SERIES Precision Reflectometer Couplers	\$300.00
NARDA 765-20 20 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f)	\$135.00
NARDA 766-10 10 dB Attenuator, 20 Watts, DC-4 GHz, N(m/f)	\$100.00
NARDA 792FF Variable Attenuator, 0-20 dB, 2.0-12.4 GHz	\$375.00
NARDA 794FM Direct Reading Variable Attenuator, 0-40 dB, 4-8 GHz	\$375.00
OMNI-SPECTRA 2085-6010-00 Crystal Detector, 1-18 GHz, negative polarity, SMA(m/f)	\$50.00
PAMTECH KYG1014 WR42 Junction Circulator, 18.0-26.5 GHz	\$250.00
SONOMA ENG. S-4901 WR15 Junction Isolator, 57-59 GHz, 30 dB isolation	\$125.00
SONOMA ENG. S-4906 WR15 Junction Isolator, 60-62 GHz, 30 dB isolation	\$125.00
SONOMA ENG. S-4907 WR15 Junction Isolator, 62-64 GHz, 30 dB isolation	\$125.00
SONOMA SCIENTIFIC 21A3 WR42 Circulator, 20 dB, 20.6-24.8 GHz	\$75.00
SPACEK LABS DQ-1 WR22 Flat Broadband Detector, 33-50 GHz	\$400.00
SPACEK LABS K-2X Frequency Doubler, 9.0-13.25 GHz in/ 18.0-26.5 GHz out	\$350.00
SPACEK LABS KA-3X Frequency Tripler, 8.83-13.33 GHz in/ 26.5-40.0 GHz out	\$350.00
TRG B528 WR22 Direct Reading Phase Shifter, 0-360 deg., 33-50 GHz	\$1,250.00
TRG V551 WR15 Frequency Meter, 50-75 GHz	\$600.00
TRG W551 WR10 Frequency Meter, 75-110 GHz	\$750.00
WAVELINE 100080 WR28 Terminated Crossguide Coupler, 30 dB	\$200.00
WEINSCHTEL 1515 Power Divider, 2-Way, DC-18 GHz, SMA(m/f/f)	\$125.00
WEINSCHTEL DS109 Double Stub Tuner, 1-13 GHz, N(m/f)	\$150.00
WEINSCHTEL DS109LL Double Stub Tuner, 0.2-2.0 GHz, N(m/f)	\$150.00

COMMUNICATIONS

HP 59401A HP1B Bus Analyzer	\$700.00
TEK 1410R NTSC Gen., w/SPG2 sync. generator, TSG7 color bars	\$800.00
TEK 1411R PAL Gen., w/SPG12 sync; TSG11 color bars; TSG13 linearity	\$750.00
TEK 1411R PAL Test Gen., w/SPG12, TSG11, TSG13, TSG15, TSG16	\$1,000.00
TEK 1411R PAL Test Gen., w/SPG12, TSG11, TSG12, TSG13, TSG15, TSG16	\$1,100.00
TEK 1411R-opt.04 PAL Test Gen., w/SPG12, TSG11, TSP11, TSG13, TSG15, TSG16	\$1,400.00
TEK 1420 NTSC Vectorscope	\$600.00
TEK 147A NTSC Test Signal Generator, with noise test signal	\$800.00
TEK 148 PAL Insertion Test Signal Generator	\$700.00
TEK 1750 NTSC Waveform / Vector Monitor	\$2,250.00
TEK 520A NTSC Vectorscope	\$750.00
TEK 521A PAL Vectorscope	\$750.00

MISCELLANEOUS

P.A.R. 5101 Lock-In Amplifier, 5 Hz-100 kHz	\$650.00
P.A.R. 5206-95, 98 Two-Phase Lock-In Amp., 2 Hz-100 kHz, GPIB	\$1,500.00
P.A.R. 5209 Lock-In Amp., 0.5 Hz-120 kHz, 130 dB dynamic reserve	\$2,500.00
TEK TM5006 5000-series 6-slot Programmable Power Module	\$600.00
TEK TM504 500-series 4-slot Power Module	\$175.00
TEK TM506 500-series 6-slot Power Module	\$250.00
TEK TM515 500-series 5-slot Traveller Power Module	\$275.00

SECURITY ELECTRONICS SYSTEMS AND CIRCUITS

— Part 5

by Ray Marston

IR LIGHT-BEAM ALARM BASICS

Last month's episode of this 'Security Electronics' series explained (among other things) the basic operating principles of visible light-beam alarm circuits, and ended by explaining that virtually all modern light-beam security systems, in fact, operate in the invisible infrared (rather than visible light) range. Use one or more pulse-driven IR LEDs to generate the transmitter's 'light-beam,' and use matching IR photodiodes or phototransistors to detect the beam at the receiver end of the system. The graph of Figure 1 conveys some useful information regarding the spectral response of the human eye, and of general-purpose and IR photodiodes and phototransistors.

Thus, the human eye is sensitive to a range of electromagnetic light radiation; it has a peak spectral response to the

color green, which has a wavelength of about 550nm, and has relatively low sensitivity to the color violet (400nm) at one end of the visible-light spectrum, and to dark red (700nm) at the other. The human eye is blind to electromagnetic light radiation beyond this narrow spectrum.

Optoelectronic semiconductor devices such as photodiodes and phototransistors have spectral responses that are determined by the chemistry of their semiconductor junction material.

General-purpose 'light sensi-

tive' types have (as shown in Figure 1) typical spectral responses that straddle the human visibility spectrum, but IR types operate at a peak wavelength of about 900nm and generate an output spectrum that is well beyond the range of normal human visibility. IR light-beams are thus invisible to human eyes.

A simple IR direct light-beam intrusion detector or alarm system can be made by connecting an IR light-beam transmitter and IR receiver in the basic way shown in Figure 2. Here, the transmitter feeds a coded pulse-type signal (often a simple squarewave) into an IR LED that has its output focused into a fairly narrow beam (via a molded-in lens in the LED casing) that is aimed at a matching IR photodetector (phototransistor or photodiode) in the remotely placed receiver.

The system action is such

Ray Marston looks at IR light-beam and PIR movement-detector circuits and systems in this month's episode of the series.

that the receiver output is 'off' while the light-beam reaches the receiver, but turns on and activates an external alarm or other mechanism if the beam is interrupted by a person or other object.

This basic type of system can be designed to give a useful detection range of up to 20 meters when used with additional optical focusing lenses, or up to five meters without extra lenses.

Note that the simple Figure 2 light-beam alarm system works on a strict line-of-sight principle between the Tx and Rx lenses, and the alarm may thus activate if any object with a diameter greater than the smaller of the two lenses enters the beam's line-of-sight.

Thus, a weakness of this simple system is that it can easily be false-triggered by relatively small insects entering the beam or resting on one of the lenses. The improved dual light-beam system shown in Figure 3 does not suffer from this defect.

The Figure 3 system is basically similar to that already described,

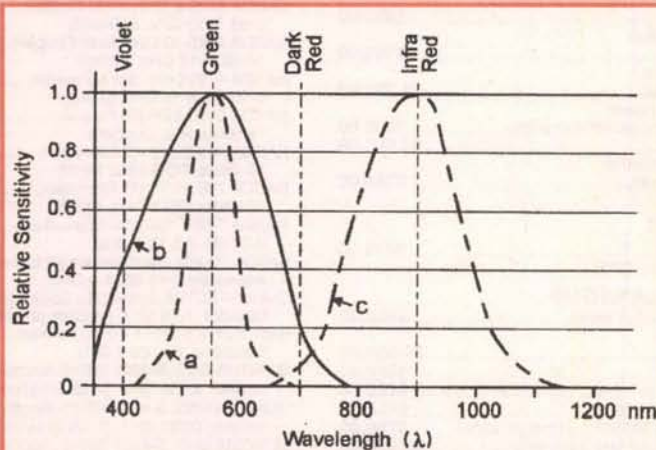


Figure 1. Typical spectral response curves of (a) the human eye and (b) general-purpose, and (c) IR photodiodes/transistors.

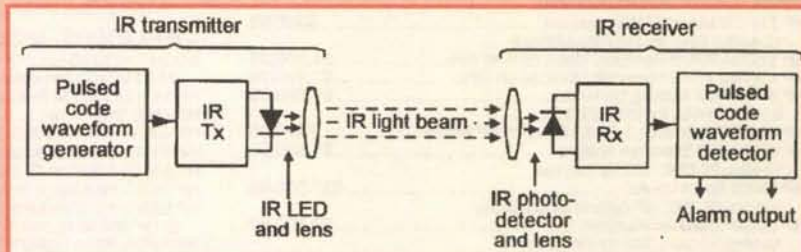


Figure 2. Simple IR direct light-beam alarm system.

fax parts

YOUR ONE STOP SOURCE ALL BRANDS AND MODELS

Cyber-Test, Inc., America's largest independent fax board repair depot, now sells hard to find parts for most brands of thermal and plain paper facsimiles. Let Cyber-Test be your one-stop shop for all of your fax repair needs.

CALL US TODAY

800-881-3344 • www.faxrepair.com

CYBER-TEST

448 Commerce Way, Building 100, Longwood, FL 32750
Fax 407-260-0922

World Passing You By?

Are you interested in Microprocessors & Embedded Control Systems? If not you should be! Look around, just about everything these days has an embedded microprocessor in it. TVs, cars, radios, traffic lights & even toys have embedded computers controlling their actions. The Primer Trainer is the tool that can not only teach you how these devices operate but give you the opportunity to program these types of systems yourself. Examples & exercises in the Self Instruction manual take you from writing simple programs to controlling motors. Start out in Machine language, then move on to Assembler, & then continue on with optional C, Basic, or Forth Compilers. So don't be left behind; this is information you need to know!

Examples Include:

- Measuring Temperature
- Using a Photocell to Detect Light Levels
- Making a Waveform Generator
- Constructing a Capacitance Meter
- Motor Speed Control Using Back EMF
- Interfacing and Controlling Stepper Motors
- Scanning Keypads and Writing to LCD/LED Displays
- Bus Interfacing an 8255 PPI
- Using the Primer as an EPROM Programmer
- DTMF Autodialer & Remote Controller (New!)

The PRIMER is only \$119.95 in kit form. The PRIMER Assembled & Tested is \$169.95. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade (\$49.95). The Upgrade includes: an RS232 serial port & cable, 32K of battery backed RAM, & Assembler/Terminal software. Please add \$5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad (\$29.95) installed. Satisfaction guaranteed.

EMAC, inc.

11 EMAC WAY, CARBONDALE, IL 62901
618-529-4525 Fax 457-0110 BBS 529-5708
World Wide Web: <http://www.emacinc.com>

1985 - 1998
OVER
12
YEARS
OF SERVICE

but transmits the IR beam via two series-connected LEDs that are spaced about 75mm apart, and receives the beam via two parallel-connected photo-detectors that are also spaced about 75mm apart.

Thus, each photodetector can detect the beam from either LED, and the receiver's alarm will thus activate only if *both* beams are broken simultaneously, and this will normally only occur if a large (greater than 75mm) object is placed within the composite beam. This system is thus virtually immune to false triggering by insects, etc.

Note that, as well as giving excellent false-alarm immunity, the dual light-beam system also gives (at any given LED drive-current value) double the effective detection range of the simple single-beam system, since it has twice as much effective IR transmitter output power and twice the receiver sensitivity.

IR SYSTEM WAVEFORMS

IR light-beam systems are

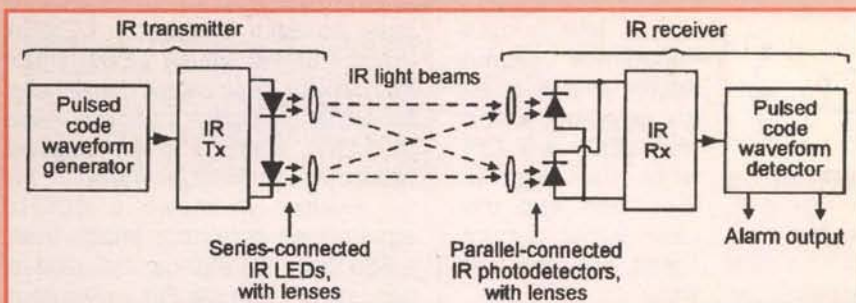


Figure 3. IR dual light-beam alarm system.

usually used in conditions in which high levels of ambient or background IR radiation (generated by natural or artificial heat sources) already exist. To enable the systems to differentiate against this background radiation, and give good effective detection ranges, the transmitter beams are invariably pulse-coded, and the receivers are fitted with matching pulse-code detection.

In practice, the transmitter beams usually use either a continuous-tone or a tone-burst type of pulse-coding, as shown in Figure 4.

IR LEDs and photodetectors are very fast-acting devices, and the effective range of an IR beam system is thus determined by the peak currents fed into the transmitting LED (or LEDs), rather than by the mean LED current.

Thus, if the waveforms of Figure 4 are used in IR transmitters giving peak LED currents of 100mA, both systems will give the same effective operating range, but the Figure 4(a) continuous-tone transmitter will consume a mean LED current of 50mA, while the tone-burst system of Figure 4(b) will consume a mean current of only 1mA (but will require a more complex circuit design).

The operating parameters of the tone-burst system require careful consideration, since this type of IR intrusion detecting system actually works on a 'sampling' principle and is usually intended to detect the presence of a human intruder.

Note that humans moving at normal walking speed take about 200mS to pass any given point, so IR light-beam systems do not need to be switched on continuously to detect a human intruder, but only need to be turned on for brief 'sampling' periods at repetition periods that are far shorter than 200mS (at, say, 50mS).

The actual sample period can be very short relative to the repetition period, but must be long relative to the tone frequency period. Thus, a good compromise is to use a 20KHz tone with a burst or 'sample' period of 1mS and a repetition period of 50mS, as shown in the waveform example of Figure 4(b).

IR SYSTEM DESIGN

The first step in designing any electronic system is that of devising the system's block diagrams.

Figure 5 shows a suitable block diagram of a continuous-tone IR light-beam intrusion alarm/detector system, and Figure 6 shows the block diagram of a tone-burst version of the system. Note that a number of blocks (such as the IR output stage, the tone pre-amp, and the output driver) are common to both systems.

The continuous-tone system (Figure 5) is very simple, with the transmitter comprising nothing more than a squarewave generator driving an IR output stage, and the receiver comprising a matching tone pre-amplifier and code waveform detector, followed by an output driver stage that can activate a device such as a relay or alarm, etc.

The tone-burst system (Figure 6) is rather more complex, with the transmitter comprising a free-running pulse generator (generating 1mS pulses at 50mS intervals) that drives a 20KHz squarewave generator which, in turn, drives the IR output stage that generates the final tone-burst IR light beam.

In the receiver, the beam signals are picked up and passed through a matching pre-amplifier and then passed on to a code waveform detector/expander block, which ensures that the alarm does

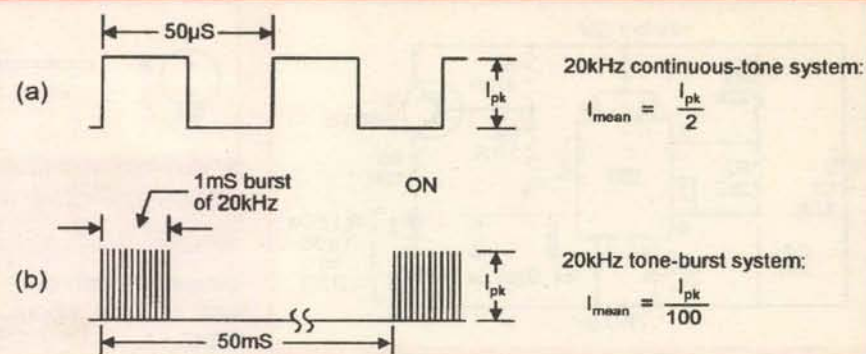


Figure 4. Alternative types of IR light-beam pulse-code waveforms, with typical parameter values.

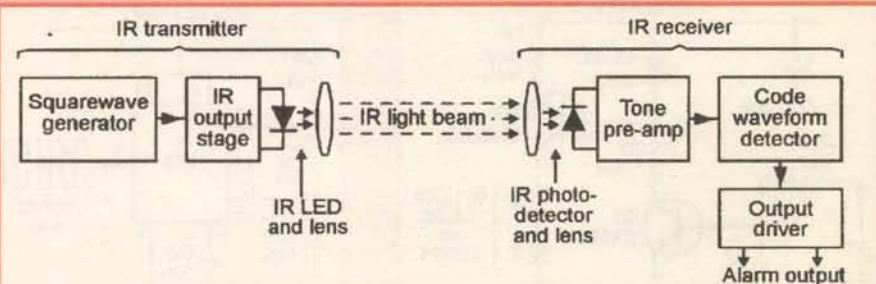


Figure 5. Block diagram of a continuous-tone IR light-beam intruder alarm/detector system.

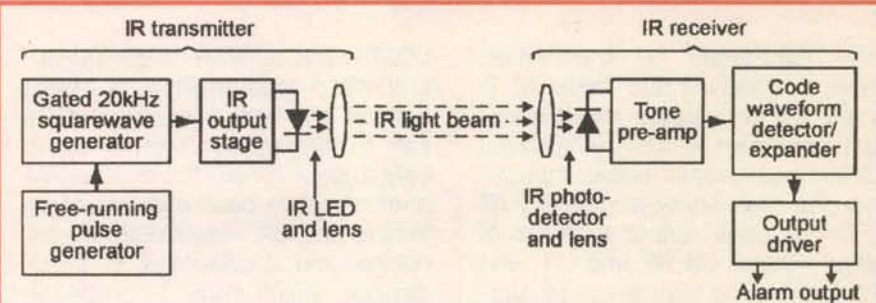


Figure 6. Block diagram of a tone-burst IR light-beam intruder alarm/detector system.

not activate during the 'blank' parts of the IR waveform. The output of the expander stage is fed to the output driver.

IR LIGHT-BEAM TRANSMITTER CIRCUITS

Figure 7 shows the practical circuit of a simple continuous-tone

PIC'n Books

LEARN ABOUT PIC16/17 MICROCONTROLLERS

EASY PIC'n Beginner

- Programming techniques
- Instruction set
- Addressing modes
- Bit manipulation
- Subroutines
- Sequencing
- Lookup tables
- Interrupts
- Using a text editor - source code
- Using an assembler
- Timing and counting
- Interfacing - I/O conversion
- Lots of examples

\$29.95

PIC'n Up The Pace Intermediate

- Serial communication
- PIC16 to peripheral chips
- PIC16 to PIC16
- Serial EEPROMS
- LCD interface
- Scanning keypads
- D/A conversion
- Sensors - analog voltage output
- A/D conversion
- Math routines
- Decimal interface
- PIC16F84 EEPROM data memory
- Lots of circuits and code

\$34.95

+ \$4 s/h in US for one book, \$5 both books
VISA, MC, AMEX, MO, Check
CA residents please add 7.25% CA sales tax
PIC is a trademark of Microchip Technology Inc.

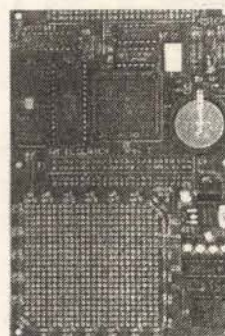
SQUARE 1 ELECTRONICS

P.O. Box 501, Kelseyville, CA 95451
Voice (707) 279-8881 FAX (707) 279-8883
http://www.sq-1.com
E-Mail sqone@pacifi.net

MORE POWER!

68HC11, 80C51 & 80C166

AM Research supports over 30 of the most popular Embedded controllers with both **hardware** and **software**.



- ✓ More Microcontrollers
- ✓ Faster Hardware.
- ✓ Faster Software.
- ✓ More Productive.
- ✓ More Tools & Utilities.
- ✓ IIC Peripherals.
- ✓ Single Chip Capable.
- ✓ Outstanding Support.
- ✓ Custom designs.

Call or email for a free full line brochure

Orders (800) 949-8051
Info (916) 652-7472
fax (916) 652-6642
www.amresearch.com

AM Research, Inc.
PO Box 43
The Embedded Controller Experts Loomis, CA 95650

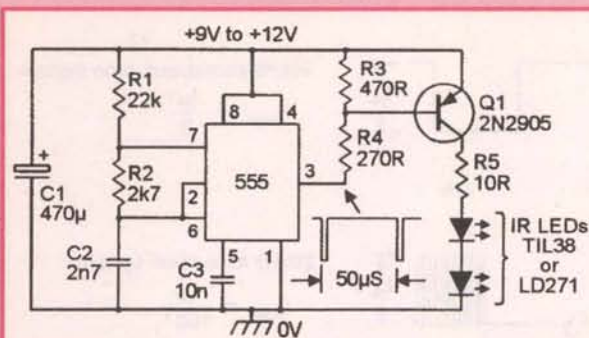


Figure 7. Simple continuous-tone IR light-beam transmitter.

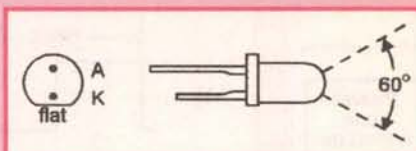


Figure 8. Outline and connections used by the LD271 and TIL38 IR LEDs.

sumes a mean current of only about 50mA.

The Figure 7 circuit can use either TIL38 or

very low input impedance (about 300R), that it gives an inverting action (the LEDs are ON when the input is low), and that the LED output current varies with the circuit's supply voltage.

Figure 9 shows an alternative universal IR transmitter output stage that suffers from none of these defects. Here, the base drive current of output transistor Q2 is

peak collector current of 1.2V/R4 amps into the two IR LEDs. Thus, this circuit's peak output current can be set by giving R4 an ohm's value of 1.2V/I, where I is the desired peak output current in amps.

Figure 10 shows a 20KHz squarewave generator (made from a 555 timer IC) that can be used in conjunction with the Figure 9 output circuit to make a continuous-tone IR beam transmitter. In this case, the Figure 9 circuit's R4 value should be at least 6R8, to limit the peak IR LED currents to less than

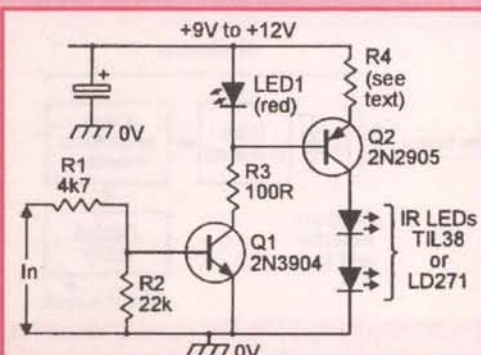


Figure 9. 'Universal' IR transmitter output stage.

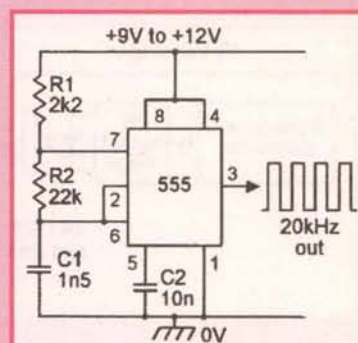


Figure 10. 20KHz square-wave 'tone' generator.

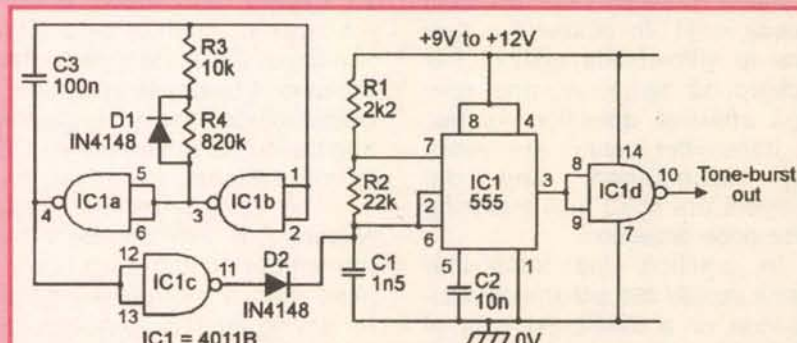


Figure 11. Tone-burst (1mS burst of 20KHz at 50mS intervals) waveform generator.

dual light-beam IR transmitter. Here, a standard 555 'timer' IC is wired as an astable multivibrator that generates a non-symmetrical 20KHz squarewave output that drives the two series-connected IR LEDs at peak output currents of about 400mA via R5 and Q1, and the low source impedance of storage capacitor C1.

The circuit's timing action is such that the ON period of the LEDs is controlled by C2 and R2, and the OFF period by C2 and (R1+R2), i.e., so that the LEDs are ON for only about one-eighth of each cycle; the circuit thus con-

LD271 (or similar) 'high power' (100mW or greater) IR LEDs. These popular and widely-available LEDs can handle mean currents up to only 100mA or so, but can handle brief repetitive peak currents of up to at least 2.5A. Figure 8 shows the outline and connections of these devices, which have a molded-in lens that focuses the output into a radiating beam of about 60° width; at the edges of the beam, the IR signal strength is half of that at the beam's center.

Minor weaknesses of the IR output stage (Q1 and R3 to R5) of the Figure 7 circuit are that it has a

derived from Q1 collector, and the Q1 circuit has an input impedance of about 5kΩ (determined mainly by the R1 value).

Thus, when the circuit's input is low, Q1 is off, so Q2 and the two IR LEDs are also off, but when the input is high, Q1 is driven to saturation via R3, thus driving LED1 (a standard red LED) and Q2 and the two IR LEDs on.

Under this latter condition, about 1.8V is developed across LED1, and about 0.6V less than this (= 1.2V) is thus developed across R4, causing Q2 to act as a constant-current generator that feeds a

200mA.

Alternatively, Figure 11 shows the circuit of a tone-burst generator that gives 1mS bursts of 20KHz at 50mS intervals, and which can be used in conjunction with the Figure 9 output stage to make an IR tone-bursts transmitter.

Here, the IC1a and IC1b sections of a 4011B CMOS quad two-input NAND gate IC are wired as a free-running asymmetrical astable multivibrator that produces 1mS and 49mS periods; this waveform is inverted and buffered by IC1c and used to gate a 20KHz 555-type squarewave generator via D2, and this squarewave is then buffered and inverted by the final 4011B stage (IC1d), ready for feeding to the input of the Figure 9 output stage.

Note when using the Figure 11 circuit that R4 in the Figure 9 output stage can be given a value as low as 2R2, to give peak output currents of up to 550mA, but that, under this condition, the transmitter will consume a mean current of little more than 6mA.

IR RECEIVER PRE-AMP DESIGN

The basic IR input signal to an IR light-beam receiver can be picked up and converted into a proportional current by either an IR photodiode or an IR phototransistor. If a photodiode is used, it can be connected in series with a load resistor (with a typical value in the range 10K to 100K), and can be used in either of the reverse-biased configurations shown in Figure 12.

The diode's basic action is such that its reverse-biased leakage current is proportional to the IR light intensity on its junction, being

PRIMECELL

IF YOU NEED NEW BATTERIES FOR YOUR ELECTRONIC EQUIPMENT
DON'T PITCH EM - SEND THEM FOR REBUILDING! - SAVE \$\$\$

CUNARD ASSOCIATES, R.D. 6 Box 104, Bedford, PA 15522

- WE INSTALL NEW NI-CAD OR NI-MH BATTERIES INTO YOUR ORIGINAL CASE.
- WE IMPROVE CAPACITY TO BETTER THAN ORIGINAL.
- WE FIX WHAT CAN'T BE FOUND. (OR AFFORDED)
- WE PROVIDE QUICK SERVICE. / EXTENDED LIFE FOR OLDER EQUIPMENT
- WE OFFER FREE QUOTES. / FREE RETURN IF QUOTE IS REFUSED.
- WE PROPERLY DISPOSE OF YOUR OLD CELLS BY RECYCLING.
- WE GIVE YOU A 12 MONTH WARRANTY.
- WE WILL BE HERE WHEN YOU NEED US / 12 YEARS IN BUSINESS.
- WE SAVE YOU **** MONEY **** \$\$\$



GENERAL ELECTRIC

MPD/PLS - MPR/MPX/MPX
19A704850P(1200mAh) \$34.95
19A704860P(1800mAh) \$39.95
PL19D429763(777)G1/3 \$37.95
MAXON SA-1155 1160 \$39.95
TAD 1450 1510 1520 \$21.95

MOTOROLA

P200 HT600 MT1000
NTN 4585 4824 5414 \$37.95
NTN 5447 5521 5545 \$37.95

MIDLAND

70-B10 B16 B19 B21 \$39.95
70-B32 70-B36 \$39.95

UNIDEN

APH56 APX500 \$21.95
APX650 1050 \$29.95
1000 1100 1200 \$34.95
BP100/200/205 \$14.95
205 Inc to 1350 \$22.95

ICOM

BP2/BP3/BP22 \$18.95
BP5/BP23/24 \$24.95
BP7/CM7/BP8 \$34.95

YAESU

FNB 3 4 12 14 16 \$32.95
FNB19 21 26 27 38 \$32.95
FNB 17 25 35 \$23.95

BENDIX KING

KR105/LAA125 \$34.95

KENWOOD

PB2/KNB3 \$29.95
PB21/21H \$14.95
PB25/H/26 \$24.95

CORDLESS DRILLS

Any brand 7.2V \$18.95
Any brand 9.6V \$29.95
Any brand 12.0V \$32.95
Any brand 14.4V \$37.95

SURVEYING EQUIP.

COMPUTERS - PHONES
Send battery for quote.

FOR INFORMATION ABOUT YOUR REQUIREMENTS CONTACT US:
PHONE OR FAX: (814) 623-7000 E-MAIL TO: PRIMECELL@AOL.COM
SEND YOUR PACKS FOR FREE QUOTATION VIA UPS, RPS OR US MAIL
DOWNLOAD OUR CATALOG, WEB SITE: <http://users.aol.com/PrimeCell>

BATTERY REBUILD SERVICE

MANY OTHERS AVAILABLE - WRITE OR CALL
FREE CATALOG
ADD \$4.50 SHIPPING & HANDLING PER ORDER




Honey, I shrank the COMPUTER!




As low as \$29

Call for a
catalog or visit
our Web site
today.

www.micromint.com

(800) 635-3355
(860) 871-6170

4 Park St. • Vernon, CT 06066



BASIC Stamp is a registered trademark of Parallax, Inc.

very low under dark conditions and relatively high when brightly illuminated; this current is converted into a proportional output voltage by R1.

An IR phototransistor can be used by connecting it in either of the basic ways shown in Figure 13(a) or (b), in which load resistor R1 has a typical value in the range 1K0 to 33K. Most phototransistors have only two externally-accessible leads (collector and emitter), but a few are three-lead types with an accessible base lead; a three-lead

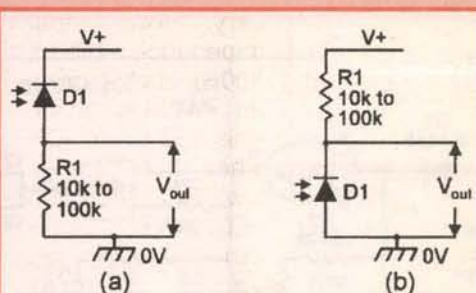


Figure 12. Alternative ways of using a photodiode as a light-to-voltage converter.

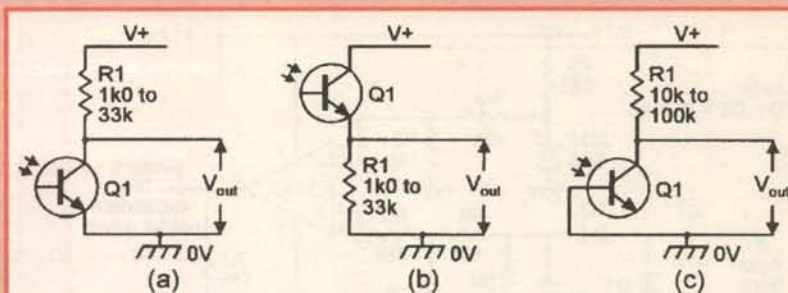


Figure 13. (a) and (b); alternative phototransistor configurations. (c); a three-lead phototransistor use as a photodiode.

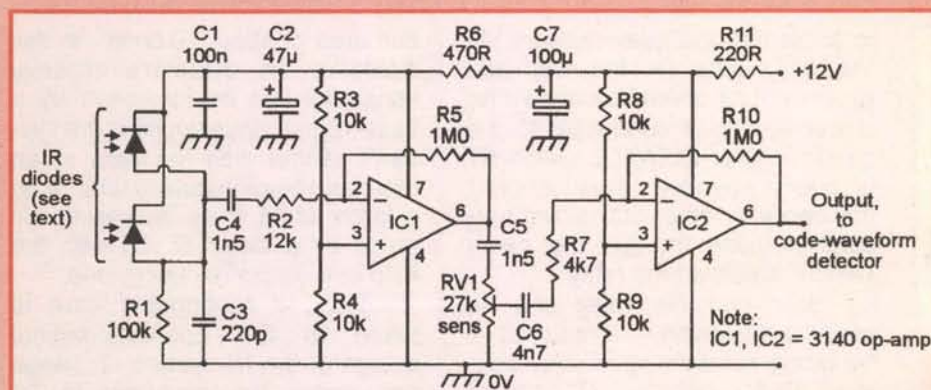


Figure 14. IR receiver pre-amplifier circuit.

device can be used as a photo-transistor by connecting it in either of the basic ways already shown, or it can be used as a photodiode by wiring it in the way shown in Figure 13(c).

Note that a phototransistor's sensitivity is typically 100 times greater than that of a photodiode, but its maximum operating frequency (typically a few hundred KHz) is proportionally lower than that of a photodiode (typically 10s of MHz). Also note in Figures 12 and 13 that the photosensor exhibits a high sensitivity but a low cut-off frequency if R1 has a high value, and a low sensitivity but high cut-off frequency if R1 has a low value.

Figure 14 shows the practical circuit of an IR light-beam receiver that is designed for use with 20KHz continuous-tone or tone-burst single-beam or dual-beam systems, and uses IR photodiodes as signal converters. Here, the two IR diodes are connected in parallel and wired in series with R1, so that the converted IR signal is developed across R1 (note that one of these diodes can be removed if the unit is used with a single-beam IR system).

The converted R1 signal is amplified by cascaded op-amps IC1 and IC2, which can provide a maximum signal gain of about x17,680 (= x83 via IC1 and x213 via IC2), but have the gain made variable via RV1.

These two amplifier stages have their frequency responses centered on 20KHz, with third-order low-frequency roll-off provided via C4-C5-C6, and with third-order high-frequency roll-off provided by C3 and the internal capacitors of the two op-amps.

The Figure 14 receiver pre-amp

circuit can be used with a variety of IR detector diode types, which ideally should be housed in black (rather than clear) infrared transmissive moldings, which greatly reduce unwanted pick-up from visible light sources. Figure 15 shows the case outline and IR-sensitive face positions of three popular IR photodiodes of this type.

The output of the Figure 14 pre-amplifier can be taken from IC2 and fed directly to a suitable code-waveform detector circuit, such as that shown in Figure 16. Note, however, that if the IR Tx-Rx light-beam system is to be used over ranges less

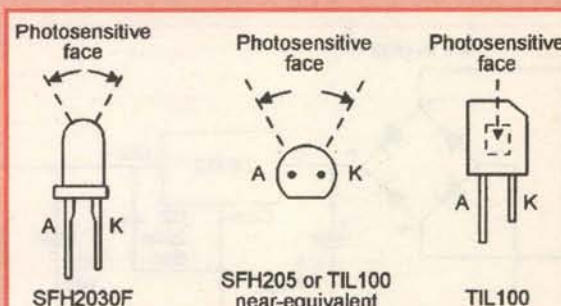


Figure 15. Case outline and IR-sensitive face positions of three popular types of IR photodiode.

than two meters or so, the pre-amp output can be taken directly from IC1, and all the RV1 and IC2 circuitry can be omitted from the pre-amp design.

A CODE WAVEFORM DETECTOR

In the Figure 16 code waveform detector circuit, the 20KHz tone waveforms (from the pre-amp output) are converted into DC via D1-D2-C2-R5-C3 and fed (via R6) to the non-inverting input of the 3140 op-amp voltage comparator, which has its inverting input connected to a thermally-stable 1V0 DC reference point.

the output follows the pulse-modulation envelope of the original transmitter signal.

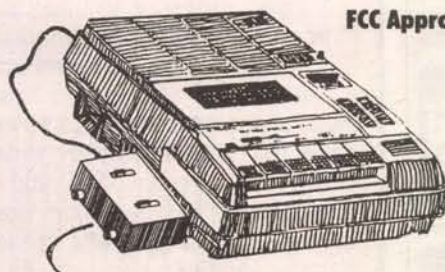
The detector output can be made to activate a relay in the absence of a beam signal by using the expander/output driver circuit of Figure 17.

AN EXPANDER/OUTPUT DRIVER

The operating theory of the Figure 17 circuit is fairly simple. When the input signal from the detector circuit switches high, C1 charges rapidly via D1, but when the input switches low, C1 discharges slowly via R1 and RV1; C1

TELEPHONE LISTENING DEVICE WITH 12 HR. RECORDER

FCC Approved



Record telephone conversations in your office or home. Starts automatically when phone is answered, records both sides of phone conversation. Recorder stops when phone is hung up. \$99.95 + \$7 shipping. For telephone listening device separately \$19.95 + \$2 ship.

For comprehensive 50 page catalog of Micro Video, VHF transmitters, Surveillance, and Counter-surveillance and much more! Send \$3.00

Call 407-725-1000

USI CORP

P.O. Box N2052 Melbourne, FL 32902

COD'S OK

Write In 35 on Reader Service Card.

Got A Battery Problem?

Get the *Ultimate* Battery Monitor

Fits 2" hole!



E-Meter

Perfect for...

- ...Emergency vehicles.
- ...Power hungry mobiles.
- ...Back up power systems.
- ...Cell/repeater monitoring.

"Batteries don't die, they're murdered"

Proven in thousands of marine, military, RV, and industrial applications, the **E-Meter** gives you the battery information you need to build and run reliable DC systems. A multi-color bar graph shows battery status at a glance. Big LED's display volts, amps, amp-hours, time or percent of capacity remaining, and kilowatt-hours. Tracks historical information including battery charge efficiency, number of discharge cycles, deepest and average depth of discharge. Optional RS232, temperature sensor, and low battery/genrun contact. Models up to 500V @1000A. 12-24V @ ≤ 500 A units are priced under \$250 w/ sensor!

Call ext. 12 with any application or OEM questions!

Cruising Equipment

5245 Shilshole Ave. NW, Seattle, WA 98107

(206) 782-8100 Fax: (206) 782-4336

See us on the web: <http://cruisingequip.com>

Write in 36 on Reader Service Card.

June 1998 31

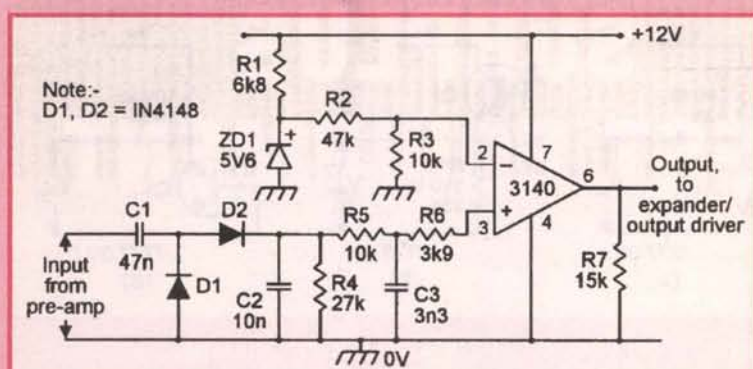


Figure 16. Code-waveform detector circuit.

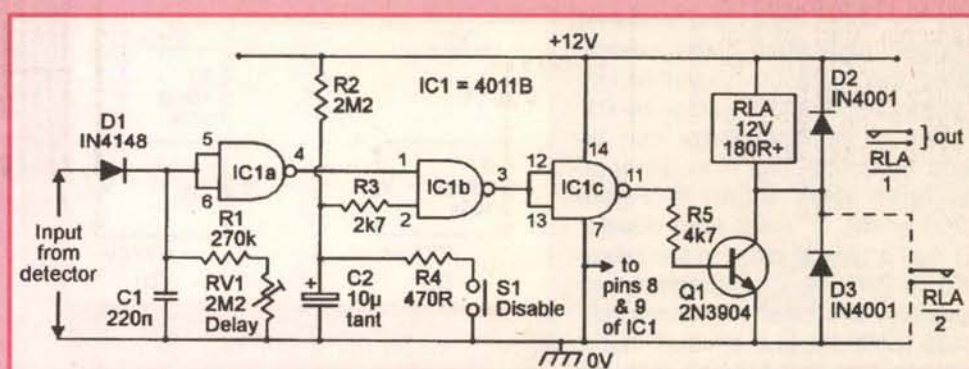


Figure 17. Expander/output driver circuit.

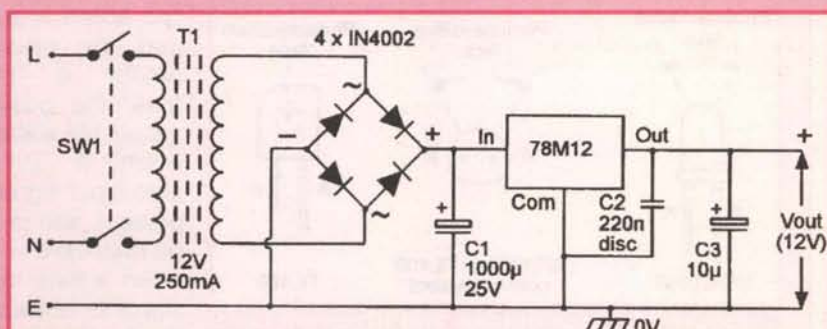


Figure 18. Line-powered regulated 12V, 250mA supply.

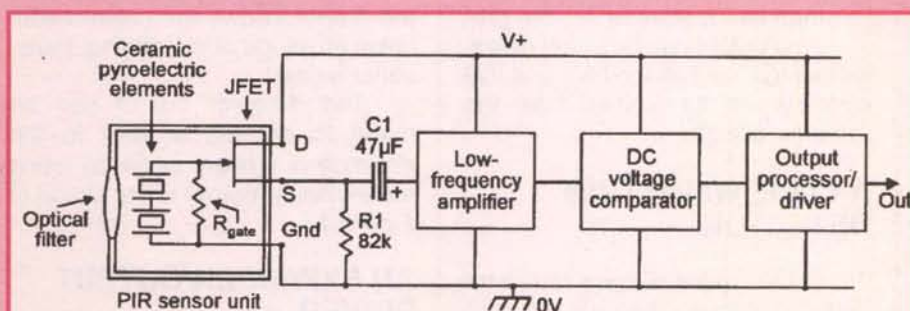


Figure 19. Basic PIR detector usage circuit.

thus provides a DC output voltage that is a 'time-expanded' version (with expansion presettable via RV1) of the DC input voltage.

This DC output voltage is buffered and inverted via IC1a, and used to activate relay RLA via Q1 and an AND gate made from IC1b and IC1c.

Normally, the other (pin 2) input of this AND gate is biased high via

R2, and the circuit action is such that (when used in a complete IR light-beam system) the relay is off when the beam is present, but is driven on when the beam is absent for more than 100ms or so. This action does not occur, however, when pin 2 of the AND gate is pulled low; under this condition the relay is effectively disabled.

The R2-C2 network's purpose

is to disable the relay network via the AND gate (in the way just described) for several seconds after power is initially connected to the circuit or after DISABLE switch S1 is briefly operated, thus enabling the owner or other authorized persons to pass through the beam without activating the relay.

Note that the relay can be made self-latching — if required — by wiring normally-open relay contacts RLA/2 between Q1 emitter and collector, as shown dotted in Figure 17.

IR LIGHT-BEAM SYSTEM RANGES

The circuits of Figures 14, 16, and 17 can be directly interconnected to make a complete IR light-beam receiver that can respond to either tone-burst or continuous-tone signals; the receiver must be powered from a well-regulated 12V DC supply unit, such as that shown in Figure 18.

The practical maximum operating range of a complete IR light-beam security system of this type is greatly affected by the types of lenses used in the system. If additional lenses are *not* used, but the Tx and Rx are carefully aimed at each other, and the Rx diodes are screened from the effects of visible light by mounting them deep inside aimed tubing, the maximum range should be at least five meters, and may be as high as seven meters.

This range can be vastly increased with the help of additional focusing lenses and/or reflectors.

At the Tx end of the system, most of the optical output power of each IR LED is typically radiated over an arc of about 60°, and thus has a fairly low radiation density value. The Tx signal's radiation density value can easily be increased by a factor of four (thus doubling the system's effective range) by mounting each IR LED at the focal point of a simple torch-type optical reflector that is aimed at the receiver unit.

At the Rx end of the light-beam system, each IR photodiode has an integral lens that focuses the received IR light on to the diode's photosensitive area.

On 5mm detectors such as the SFH2030F, this lens has a collec-

tion area of about 19.6mm²; in this example, the detector's effective sensitivity can be increased by a factor of four (thus doubling the system's range) with the help of an external 10mm² focusing lens, or by a factor of 36 (thus increasing the range by a factor of six) with the help of a 30mm² focusing lens.

Thus, if reasonable care is taken in the opto-mechanical design of the IR system, its range can easily be increased to 20 meters, and possibly to 60 meters or more.

PIR MOVEMENT-DETECTING SYSTEMS

IR light-beam alarms are 'active' IR units that react to an artificially-generated source of IR radiation. Passive IR (PIR) alarms, on the other hand, react to naturally-generated IR radiation such as the heat-generated IR energy radiated by the human body, and are widely used in modern security systems.

Most PIR security systems are designed to activate an alarm or floodlight, or open a door or activate some other mechanism, when a human or other large warm-blooded animal moves about within the sensing range of a PIR detector unit, and use a pyroelectric IR detector of the type shown in Figure 19 as their basic IR-sensing element.

The basic Figure 19 pyroelectric IR detector relies on the fact that some special ceramics generate electrical charges when subjected to thermal variations or uneven heating.

Modern pyroelectric IR detectors such as the popular PIS201S and E600STO types incorporate two small opposite-polarity series-connected ceramic elements of this type, with their combined output buffered via a JFET source-follower, and have the IR input signals focused onto the ceramic elements by a simple filtering lens, as shown in the basic PIR detector usage circuit of Figure 19.

It is important to note at this point that the detector's final output voltage is proportional to the *difference* between the output voltages of the two ceramic elements.

The basic action of the Figure 19 PIR detector is such that, when a human body is within the visual

Weeder Technologies

PO Box 2426, Ft. Walton Beach, FL 32549

850-863-5723

Add \$4 ship/hand

FREE CATALOG!

Visa MasterCard

Pro-Kit

Stackable RS-232 Kits

Digital I/O - 12 I/O pins individually configurable for input or output. DIP switch addressable; stack up to 16 modules on same port for 192 I/O points. Turn on/off relays. Sense switch transitions, button presses, 4x4 matrix decoding using auto-debounce and repeat. **\$32**

Analog Input - 8 input pins. 12-bit plus sign self-calibrating ADC. Returns results in 1mV steps from 0 to 4095. Software programmable alarm trip-points for each input. DIP switch addressable; stack up to 16 modules on same port for 128 single-ended or 64 differential inputs. **\$49**

Home Automation (X-10) - Connects between a TW523 and your serial port. Receive/transmit all X-10 commands with your home-brewed programs. Full collision detection with auto re-transmission. **\$39**

Caller ID - Decodes the caller ID data and sends it to your serial port in a pre-formatted ascii character string. Example: "12/31 08:45 850-863-5723 Weeder, Terry <CR>". Keep a log of all incoming calls. Block out unwanted callers to your BBS or other modem applications. **\$35**

Touch-Tone Input - Decodes DTMF tones and sends them to your serial port. Keep a log of all outgoing calls. Use with the Caller ID kit for a complete in/out logging system. Send commands to the Home Automation and/or Digital I/O kits using a remote telephone. **\$34**

50 MHz Freq Counter

Reads frequency from 1Hz to 50MHz and displays up to 7 digits on a 16 character LCD. Auto-range feature provides floating decimal point and automatic placement of suffix (Hz, KHz, or MHz). Microcontroller based provides for very small parts count. **\$48**

DTMF Decoder/Logger

Keep track of all numbers dialed or entered from any phone on your line. Decodes all touch-tones and displays them on a 16 character LCD. Holds the last 240 digits in a non-volatile memory which can be scrolled through. Connect directly to radio receiver's speaker terminals for off-air decoding of repeater codes, or numbers dialed on a radio program. **\$55**

IR Remote Control Receiver

Learns and responds to the data patterns emitted by standard infrared remote controls used by TVs, VCRs, Stereos, etc. Lets you control all your electronic projects with your TV remote. 7 individual output pins can be assigned to any button on your remote, and can be configured for either "toggle" or "momentary" action. **\$32**

Telephone Call Restrictors

Two modes of operation; either prevent receiving or placing telephone calls (or call prefixes) which have been entered into memory, or prevent those calls (or call prefixes) which have "not" been entered into memory. Use touch-tone phone to program.

Block out selected outgoing calls. Bypass at any time using your password. **\$35**

Block out selected incoming calls. Calls identified using Caller ID data. **\$48**

field of the pyroelectric elements, part of that body's radiated IR energy falls on the surfaces of the elements and is converted into small, but detectable, variation in surface temperature and corresponding variation in the output voltage of each element.

If the human body (or other source of IR radiation) is stationary in front of the detector's lens under this condition, the two elements generate identical output voltages and the unit's final 'difference' output is thus zero. But, if the body is moving while in front of the lens, the two elements generate different output voltages and the unit produces a varying output voltage.

Thus, when the PIR unit is wired as shown in the Figure 19 basic usage circuit, this movement-inspired voltage variation is made externally available via the buffering JFET and DC-blocking capacitor C1 and can, when suitably amplified and filtered, be used to activate an alarm or other mechanism when a human body movement is detected.

In practice, pyroelectric IR detectors of the simple type just described have — because of the small size (usually about 20mm²) and simple design of the detector's IR-gathering lens — maximum useful detection ranges of roughly one meter.

In modern commercial PIR movement detecting security units, however, this range is greatly extended (usually to well over 10 meters) with the aid of a large (about 2000mm²) multi-faceted external IR-gathering/focusing plastic lens, which splits the visual field into a number of parallel strips and focuses them onto the two sensing areas of the PIR unit.

Figure 20 shows the typical PIR sensing pattern of a commercial 'intrusion detector' unit designed to protect a normal-sized room in domestic-type applications. In this example, the unit is mounted on a wall at a height of seven feet and is aimed downwards at a shallow angle, and the multi-faceted plastic lens splits the visual field into a large number of vertical and horizontal segments.

Any person moving through a single segment will activate a single trigger signal within the PIR sensor; a person moving through the entire visual field will thus produce numerous triggering signals,

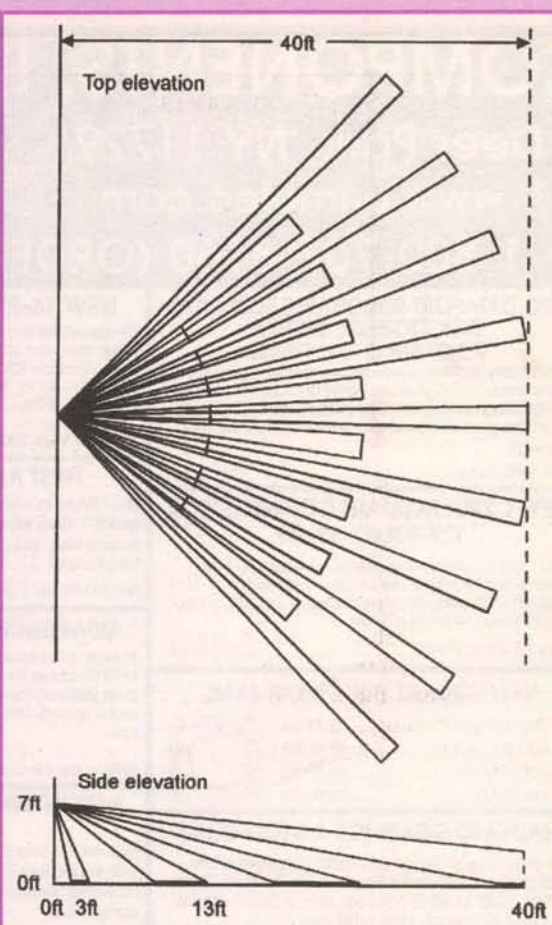


Figure 20. Typical PIR sensing pattern of a commercial 'intrusion detector' unit designed for normal domestic-type applications.

but a stationary IR source will produce no signals.

Most intrusion detectors of this type incorporate 'event counting' circuitry that will only generate an alarm-activating output if three or more trigger signal are detected within a few seconds, thus minimizing the chances of a false alarm due to sudden changes in temperature caused by the auto-activation of time-switched security lights, etc.

The lens-generated PIR sensor pattern shown in Figure 20 is the type that is often used in burglar-alarm systems to protect a single room in a medium-sized house. Alternative (and usually interchangeable) plastic lens types, offering different ranges and coverage patterns for various special types of application, are available at low cost from many commercial PIR-unit suppliers.

Among the most important of these are the 'pet' type, in which the field's vertical span is restricted to 2.5 to 6.6 feet above ground level to avoid activation by domestic pets while giving good sensitivity to normal humans, and the 'corridor' type, in which the field's horizontal span is restricted to about 20° to give long-distance coverage (typically about 30 meters) of narrow corridors and passageways.

Note that, because high-quality commercial PIR security units of this basic type are widely available at comparatively low cost, it is not practicable (on aesthetic and economic grounds) to try to build similar units on a DIY basis. NV

SURPLUS TEST EQUIPMENT

HEWLETT PACKARD

11665B, Modulator (Unused)	\$350
11683A, Range Calibrator for HP Power Meters	\$550
11720A, Pulse Modulator, 2-18GHz	\$550
11729C, Carrier Noise Test Set w/Opt. 130	\$16,500
16510B, 80 Channel, 25MHz	
State & Timing Module	\$1000
1652B, Logic Analyzer w/Oscilloscope	\$4000
3311A, Function Generator, .01Hz-1MHz	\$225
3312A, Function Generator, .1Hz-13MHz	\$700
3314A, Function Generator, .001Hz-19.99MHz	\$2800
3325A, Synthesizer/Function Generator	\$1800
3335A, Synthesizer/Level Gen., 200Hz-80MHz	\$5000
334A, Distortion Analyzer	\$250
339A, Distortion Analyzer	\$1200
3455A, Digital Voltmeter	\$400
3456A, Digital Multimeter, 6.5 Digits	\$800
3457A, Multimeter	\$2000
3478A, Digital Multimeter	\$700
3488A, Switch Control	\$1000
3551A, Transmission Test Set	\$950
3562A, Dynamic Signal Analyzer	\$9250
3562A, Dynamic Analyzer w/Opt. 063	\$11,500
35677A, S-Parameter Test Set	\$2700
3575A, Phase Gain Meter 1Hz-13MHz	\$1000
3581C, Selective Voltmeter	\$800
3582A, Spectrum Analyzer, .02Hz-25.5KHz	\$2500
3586B, Selective Level Meter	\$750
3586C, Selective Level Meter	\$800
3779D, Multiplexer Analyzer	\$2500
3852A, Data Acquisition/Control Unit	\$1800
4193A, Vector Impedance Meter	\$7500
4342A, Q-Meter	\$1800
435A, Power Meter	\$150
435B, Power Meter	\$500
436A, Power Meter w/Opt. 022	\$1200
4935A, Transmission Impairment Test Set w/Opt. 001	\$1500
5314A/01/02, Universal Counter	\$225
5316B, Universal Counter	\$1000
5328B, Universal Counter	\$1000
5334A, 100MHz Universal Frequency Counter	\$1000
5334B, Universal Counter	\$1000
5335A, Frequency Counter, Opt. 10/20	\$1200
5340A, Frequency Counter, 10Hz-18GHz	\$800
5340A, Frequency Counter w/Opt. 01/02/011	\$1350
5354A, Frequency Converter	\$800
5355A, Frequency Converter	\$1000
5356A, Converter Head	\$950
54100A, Digitizing Oscilloscope	\$3000
54201A, Digitizing Oscilloscope, 300MHz	\$2500
54201D, Digitizing Oscilloscope	\$2650
6002A, Opt. 01, Power Supply, HP-IB, 0-50V/0-10A	\$700
6034A, DC Power Supply, 0-60V, 0-10A	\$1350
6186C, DC Power Source, 0-300V, 0.100 MA	\$850
6227B, Dual Power Supply, 0-25V/0-2A	\$600
6291A, DC Power Supply, 0-40V, 0-5A	\$650
6469C, DC Power Supply, 0-36V, 0-300A	\$3000
6623A, Triple Output Power Supply	\$2800
7090A, Measuring Plotter	\$1200
8011A, Pulse Generator	\$400
8011A, Pulse Generator w/Opt. 001	\$500
8012B, Pulse Generator	\$750
8013B, Pulse Generator	\$750
8165A/002, Programmable Signal Source w/AM	\$2200
8182A, Data Analyzer	\$1500
8350A, Sweep Oscillator Mainframe	\$2500
8350B, Sweep Oscillator Mainframe	\$3500
83540A, RF Plug-in, 2.0-8.4GHz	\$3000
83540A/002, RF Plug-in, 2-8.4GHz	\$3500
83545A, Oscillator Plug-in, 5.9-12.4GHz	\$2500
8411A/018, Frequency Converter .11 to 18GHz	\$500
8501A, Storage Normalizer	\$1000
853A/8558B, Spectrum Analyzer, 100KHz-1500MHz	\$3850
853A/8559A, Spectrum Analyzer, 10MHz-21GHz	\$4750
8554B, RF Spectrum Analyzer Plug-in, 500KHz-1250MHz	\$800
8559A, Spectrum Analyzer Plug-in, .01-21GHz	\$2650
8566A/B, Spectrum Analyzer, 100Hz-22GHz (325GHz with mixers)	\$35,000
8640B, Signal Generator, Opt. 002, .5-1024MHz	\$2100
8640B, Signal Generator, Opt. 1, 2	\$2200
8654A, Signal Generator, 10-520MHz	\$600
8656A, Signal Generator, 100KHz-990MHz	\$2500
8671B, Synthesized Signal Gen., 2-18GHz	\$6500
8672A, Synth. Signal Gen., 2.0-18.0GHz	\$10,500
8684A, Signal Generator, 5.4-12.5GHz	\$2350
8746B, S-Parameter Test Set, 5-12.4GHz	\$700
8756A, Scalar Network Analyzer	\$1500
8757A, Scalar Network Analyzer, 10MHz-60GHz	\$5000
8770A, Arbitrary Waveform Synthesizer	\$3000
8901B, Modulation Analyzer	\$5000
8903B/001, Audio Analyzer	\$3000

8904A, Multifunction Synthesizer w/Opt. 002	\$2500
8904A/001/003, Multifunction Synthesizer	\$2800
8970A, Noise Figure Meter	\$5000

TEKTRONIX

1502, TDR Cable Tester w/Opt. 04 Recorder	\$1700
1503, TDR Cable Tester w/Opt. 04 Recorder	\$1550
2236, 100MHz Oscilloscope w/Counter/Timer/DMM	\$1550
2337, 100MHz Oscilloscope w/DMM	\$1650
2432A, 300MHz Digital Storage Oscilloscope	\$3000
2445, Four Channel 150MHz Oscilloscope	\$1800
466, 100MHz Storage Oscilloscope w/DM44	\$800
475, 200MHz Oscilloscope	\$650
475A, 250MHz Oscilloscope	\$800
485, Oscilloscope, 350MHz	\$900
494AP, Programmable Spectrum Analyzer, 10KHz-21GHz	\$16,000
520A, Vectorscope	\$400
7A42, Four Channel Amplifier Plug-in	\$650
7D20, Programmable Digitizer	\$400
7L5/L3, Spectrum Analyzer, 20Hz-5MHz, w/Opt. 025 Tracking Generator	\$1850
7L12, Spectrum Analyzer, 100KHz-1.8GHz	\$1500
7L13, Spectrum Analyzer, 1KHz-1.8GHz	\$1800
7L18, Spectrum Analyzer Plug-in, 1.5-18GHz	
Capable of 60GHz with Mixers	\$2500
7S12, TDR/Sampler	\$450
AA5001, Programmable Distortion Analyzer	\$1700
AM503, Current Probe Amplifier	\$400
CG5001, Programmable Calibration Generator	\$4000
CSA803, Sig. Analyzer w/(2) SD22 & (1) SD42	\$15,000
R2246, 4 Channel Oscilloscope, 150MHz	\$1650
SG5010, Programmable Oscillator	\$3000
SG504, Leveled Sinewave Generator	\$2200
TM5003, Three Slot Power Mainframe	\$450
TM5006, Six Slot Power Mainframe	\$550
TR503, Tracking Generator for 492/4/5/6	\$850

MISCELLANEOUS

Acme Elect. PS2L1000, Electronic Load	\$850
Boonton 102F, AM/FM Signal Generator, DC-1040MHz	\$1850
California Inst. 4500L/M3, AC Power Source	\$6000
California Inst. 4503L, AC Power Source	\$5000
Eaton 2052B, Amplifier, 100-512MHz	\$800
EIP 545A, Microwave Frequency Counter	\$1500
Fluke 5100B/03/05, Multifunction Calibrator	\$4000
Fluke 5100B/05, Multifunction Calibrator	\$3500
Fluke 5101B/03, Calibrator	\$4500
Fluke 5200A, AC Voltage Calibrator	\$2000
Fluke 5440B, Precision DC Voltage Calibrator	\$4500
Fluke 752A, Reference Divider	\$3000
Fluke 845AR, Voltmeter/Null Detector	\$350
Fluke 8520A, Digital Multimeter	\$700
Gen-Rad 1482B, Standard Inductor, 100UH	\$400
Gen-Rad 1482E, Standard Inductor, 1mH	\$350
Gen-Rad 1482L, Standard Inductor, 100mH	\$350
Gen-Rad 1482P, Standard Inductor, 1 Henry	\$400
Gen-Rad 1633A, Incremental Inductance Bridge	\$1700
Kikusui PAD16-10L, Power Supply, 16V, 10A	\$300
Kikusui PLZ700W, Electronic Load	\$850
Krohn-Hite 3202/R3202, Tunable Filter/Rack Version	\$500/\$350
Krohn-Hite 3342, Tunable Filter	\$1000
Marconi 2019A, Signal Gen., 80KHz-1040MHz	\$2750
Phillips 5191, Prog. Synthesizer/Function Gen. 0.1MHz-2.147MHz	\$1750
Phillips PM5715/11, 50MHz Pulse Generator (New)	\$1300
Phillips 6652C, Prog. High Res. Counter/Timer, 8 Digit, 120MHz	\$1300
Sorensen DCR300-33T, DC Power Supply 300V/33A	\$2750
Sorensen DCS40-25, DC Power Supply, 40V/25A	\$750
Stanford SR400, Photon Counter	\$1850
Trans Devices DLR400 15 3500A, Dynamic Load	\$1500
Valhalla 2703, AC Voltage Standard	\$2350
Wandell Goltzman SPM19, Level Meter, 50Hz-25MHz	\$2750
Wavetek 178, Automatic Synthesizer	\$1850
Wavetek 2002, Signal Generator, 1-2500MHz	\$1500
Wavetek 3000, Signal Generator, 1-520MHz	\$900
Wavetek 3000-200, Signal Generator	\$900
Wavetek 3001, Signal Generator 1-520MHz	\$1000
Wavetek 801, Pulse Generator, 5Hz-50MHz	\$800
Wavetek 802, Pulse Generator, 5Hz-50MHz w/Delay	\$600
Wavetek 8502A, Two Channel Microwave Power Meter	\$3750
Wavetek 8541, Power Meter, 10MHz-40GHz (New)	\$1500



R & S Surplus

1050 E. CYPRESS STREET, COVINA, CA 91724

(626) 967-0846 • FAX (626) 967-1999





PRIME ELECTRONIC COMPONENTS, INC.

OUR WEB SITE IS BACK UP! CHECK OUT OUR WEB SITE @ www.primelec.com

OUR WEB SITE IS BACK UP!



516-254-0101 • FAX 516-242-8995 • 1-800-707-8160 (ORDERS ONLY)

EPROM & CPU/MPUs SOCKET PULLS

Math-Coprocessor & CPU

8087-1	\$19.95	8748H	\$6.50
80287XL	\$19.95	8749	\$5.95
80386DX-16	\$4.95	8749H	\$6.50
80387SX-16	\$14.95	8751	\$8.95
80387SX-20	\$17.95	8751H	\$9.95
80387SX-25	\$19.95	8752	\$13.95
80387DX-20	\$17.95	8755	\$6.95
80387DX-25	\$24.95	MC68020RC20	\$14.95
80486SX-25 (PGA)	\$14.95	MC68020RC33E	\$19.95
AM486DX-33 (PGA)	\$17.95	MC68030RC25	\$24.95
80486DX-50 (PGA)	\$19.95	MC68030RC33	\$29.95
8741	\$3.95	MC68881RC20	\$9.95
8742	\$4.95	MC68882RC25	\$14.95
8748	\$4.95		

All parts, all socket pulls must be cleaned & erased. *Note: Speed selection available at additional charge and all parts subject to availability.

EPROMS

2708	\$0.75	27C256	\$1.35
2516	\$0.65	27512	\$1.75
2716	\$0.65	27C512	\$1.95
2732	\$0.65	27C010	\$2.25
2764	\$0.65	27C100	\$2.25
27C64	\$0.65	27C1001	\$2.25
27128	\$0.65	27C1024	\$2.25
27128A	\$0.65	27C020	\$2.95
27256	\$1.25		

All DRAMS are clean socket pulls and have full leads.			
4164-15	\$0.18 Ea.	41256-15	\$1.00 Ea.
4164-12	\$0.25 Ea.	41256-12	\$1.25 Ea.
		41256-10	\$1.35 Ea.

NEW ALPS 2.88 MEG 3.5" FLOPPY DISK DRIVE FOR 755 SERIES THINKPAD LAPTOP

New 2.88 Meg 3.5" floppy disk drive mtr. by Alps for IBM Thinkpads 755 Series computers. This drive replaces the 1.44 Meg drive by transferring it into the original mounting bracket (5 min.) and it will be auto-detected when the computer is started. Supports 720K/1.44Meg/2.88Meg standards. TP755/2.88 (IBM P/N 1619718)\$49.95 Ea.

NEW HAYES ACCURA 28.8 INTERNAL FAX/MODEM

28.8 Hayes Accura internal plug-n-play fax/modem. Card comes with Quarterdeck InternetSuite 2 and WebTalk. Requires 16 bit ISA slot. Windows 95 Plug-n-Play compatible. Five year manufacturer's warranty. Accura 28.8 Fax Modem\$49.95 Ea.

NEW INTEL A80487SX PGA MATH CO-PROCESSOR

New retail box Intel math co-processor comes complete with used guide, utility and diagnostic software. Great price and easy installation on upgradable systems. (Chip package 169 pin PGA) A80487SX\$24.95 Ea.

NEC 6X CD-ROM DRIVE FOR VERSA 2400 SERIES

New fast 6X CD-ROM add-on or upgrade for NEC Versa 2400 laptop computer. Slides easily into VersaBay 2400 slot. One year manufacturer's limited warranty. OP-260-65001 (Versa CD 6X Drive)\$69.95 Ea.

NEW MATROX MILLENNIUM PCI VIDEO CARD

Matrox's award-winning MGA 64-bit graphics processor with 2Meg of VRAM memory and PCI design. The MGA Millennium delivers superior 2D acceleration for high-end applications, CAD, etc. Board is upgradeable to 8Meg. Complete with manual and drivers. OEM packaging for Digital Equipments PC systems and compatibles. MGA-MIL/2\$54.95 Ea.

USED MICROSOFT PS/2 MOUSE (New Style Contoured Type)

Used Microsoft PS/2 mouse, from older upgraded computer systems. All test with 30-day warranty.

Used MS PS/2 Mouse\$6.95 Ea.

WALL PLUG WALL ADAPTERS

Input: 117 Vac 50/60 Hz. Outputs Available.



Quantity Pricing Available

8Vdc 500Ma	\$2.00 Ea.
9Vdc 200Ma	\$1.50 Ea.
9Vdc 300Ma	\$2.50 Ea.
9Vdc 450Ma	\$3.50 Ea.
9Vdc 500Ma	\$2.95 Ea.
9.5Vdc 750Ma	\$3.50 Ea.
12Vdc 100Ma	\$1.25 Ea.
12Vdc 200Ma	\$1.50 Ea.
12Vdc 500Ma	\$2.95 Ea.
12Vdc 600Ma	\$3.95 Ea.
12Vdc 800Ma	\$6.95 Ea.
12Vdc 830Ma	\$4.95 Ea.
14Vdc 700Ma	\$5.95 Ea.
16Vdc 1.2Amp	\$6.95 Ea.

NOW UP-TO-DATE, WINDOWS 3.1 & WINDOWS 95 SCHEDULE AND CONTACT MANAGEMENT SOFTWARE

Powerful schedule, To-Do lists, Contacts, printing Avery labels, Day timer book formats. CD-ROM contains Windows 3.1 & Windows 95 versions. 10MB hard disk space, VGA or SVGA display, mouse required. New retail box.

Now Up-To-Date (CD-ROM)\$9.95 Ea.

NEW NISCAN/GS PLUS OCR/256 GRAY SCALE SCANNER

Brand New True 256 Gray Scale Hand Scanner. Resolution: 25-400 DPI.

Scan Width: 4.2 in. Scan Length: 11 in. Interface: 16 Bit high speed (ISA) card, 64K SRAM. System Requirements: 286/386/486 PC Compatible (16MHz).

Available 16-Bit Interface slot, Windows 3.1, 4 Meg RAM, 10 Meg of Available HD space (Min.).

Mouse or Other pointing device. Software Included: Picture Publisher LE 3.1, (Imaging Software), Perceive Personal 2.1, (OCR Software)

Niscan/GS Plus\$29.95 Ea.



NEW TANDY SUPER VGA 1 MEG DRAM (16-Bit ISA Bus Type)

This board is your basic super VGA video board with 1 meg of DRAM type memory. (ISA BUS TYPE.) Core Logic Chip: WD90C31-25-00-02. Resolution/Color: 640x480/256C, 800x600/256C, 1024x768/256C, 1024x1024/16C. Note: Software drivers included with board. Windows 3.1, VESA, Autocad, etc.

Tandy SVGA 25-4055\$12.95 Ea.

NEW 300W BABY SWITCHING POWER SUPPLY UL & CSA RATED 110-220VAC

Input voltage: 110-220VAC 50Hz/60Hz UL & CSA. Output voltage: +12VDC @ 12 amp/-12VDC @ 0.5 amp; +5VDC @ 30 amp/-5VDC @ 0.5 amp.

Model # Hipro HP-300PPFS\$39.95 Ea.

CRC DATAPORT REMOVABLE SCSI HARD DISK STORAGE SYSTEM 5-1/2" BAY (3-1/2" DRIVE)

High quality SCSI hard drive removable storage system. Unit is made with aluminum frame and drive carrier with ball-bearing cooling fan. Compatible with SCSI-1 and SCSI-2 (50-pin IDE) power and drive activity LEDs, with two keys.

SCSI Dataport V\$34.95 Ea.

NEW CYRIX FASMATH COPROCESSOR CX-83D87-33-GP

New Cyrix FasMath coprocessors for 80386DX16-33 systems. This FPU unit is used in place of Intel's 80387DX16-33 part. Originally priced at \$100.00, a steal \$10.95. Case: 68 pin grid array.

Cyrix CX-83D87-33-GP\$10.95 Ea.

NEW SQUARE EQUIPMENT FANS

115 Vac 3.1" or 4.7"	\$7.95 Ea.
12 Vdc 3.1" or 4.7"	\$6.00 Ea.
12 Vdc 2-3/8"	\$4.95 Ea.
12 Vdc 2-5/8"	\$6.00 Ea.



HARVARD GRAPHICS 4.0 (CD-ROM)

The easy way to create professional presentations. Designed exclusively for Windows 95. Pentium 75 or better. 13MB to 44MB hard disk space, SVGA display, Windows 95, mouse. New retail box.

Harvard Graphics 4.0 (CD-ROM)\$24.95 Ea.

512K PCMCIA SRAM CARD

New 512K PCMCIA SRAM card made by Fujitsu. Will work in most laptop, PDA, or handheld computers with PCMCIA socket and socket management software. HP100/200, OmniGo, Zaurus, Etc. Requires one lithium coin battery (BR2325/CR2325). Note: Battery not included.

Fujitsu (512K SRAM PCMCIA)\$24.95 Ea.

NEW 28.8/V.34 PCMCIA MODEM/FAX MADE SIMPLE TECHNOLOGY

New 28.8/V.34 PCMCIA modem/FAX, cellular ready (MNP10-EC & TX-CEL Protocol) with Flash upgradeability to 33.6. Windows 95 Plug n' Play, Hot swap capabilities. Bitware Fax software included.

Note: Separate purchase of connecting cable from Simple Technology needed for cellular operation. 28.8 Communicator (Simple Tech.)\$49.95 Ea.

USED PULLED WORKING ASSORTED HARD DRIVES

Pulled from working equipment, tested and guaranteed for 30 days. IDE and SCSI, from 40 Megs to 500 Megs. Call for availability, model numbers, and current pricing.

NEW TEAC 1.2 MEG 5-1/4" FLOPPY DRIVE

5-1/4" Half Height Teac. Model #FD-55GFR. Tan face plate only. 1.2M TEAC FD-55GFR\$14.95 Ea.

INTEL PCMCIA 10/100 ETHERNET ADAPTERS

These 16-bit PCMCIA ethernet adapters are tested demo units in excellent condition. Limited quantity available. Consists of card, cable, driver disk (WIN95 Plug & Play). Note: Sorry, manual not supplied.

PRO/100 PCMCIA\$49.95 Ea.

NEW 16-BIT 256K ISA VGA CARDS

Designed for the PC-XT/PC-AT & compatibles, this is a basic low cost VGA video card. 256K DRAM with chips & technology 82C451. Full backward compatibility with EGA, CGA, MDA, and Hercules modes. Card type: ISA 16-bit.

Model # VGA 300 (VGA Card)\$9.95 Ea.

FIRST AID 95 BY CYBERMEDIA

New retail boxed CD-ROM version for Windows 95 and 3.1. Fixes Windows problems automatically. System Req. IBM Compatible 386 or higher PC with Windows 95, 3.1, 3.11 / 4MEG RAM / 7MEG HD Space. FirstAid 95 Ver. 2.0\$9.95 Ea.

QUARTERDECK WINprobe4 (3.5" Disk)

Powerful troubleshooting software tool for Windows and Windows 95 operating systems. Program can run over 200 individual tests to keep your system running at full speed. 1MB free HD space required. New retail box.

WINprobe 4.0 (3.5" Disk)\$9.95 Ea.

NEW INTERNAL IMES 6X IDE CD-ROM DRIVE

New 6X IDE interface, Caddyless design. Drive comes with instructions sheet, IDE cable, and driver disk for DOS and Windows. Unit is Windows95 Plug & Play compatible.

IMES 6X CD-ROM Drive\$49.95 Ea.

NEW MICRONICS PENTIUM HX CHIPSET MOTHERBOARD

New Micronics Model D5CUB Pentium AT style motherboard. This motherboard comes with built-in I/O support for 4) IDE devices, 2 com ports, floppy controller, and printer port. The motherboard is built around the Intel HX Chipset and can support MMX and NON-MMX Pentium CPUs and Cyrix 6x86 CPUs 100MHz through 200MHz, 256K cache, 4) 72-pin SIMM sockets.

Micronics D5CUB\$74.95 Ea.

NEW 1.44 MEG 3.5" FLOPPY DRIVE WITH BEIGE FACE PLATE

Floppy 1.44/Gray\$19.95 Ea.

NEW INTEL PENTIUM 60/66 CPU HEATSINK 12VDC FAN COMBO

New Pentium 60/66 heatsink 12VDC fan combo for cooling the older, hotter, CPUs. Low profile type with seven inch wires. Can be used on other CPUs if you have the physical space.. Pentium 60/66 CPU Cooler\$49.95 Ea.

NEW TEAC COMBO 700 TAPE BACKUP AND FLOPPY DRIVE 1.44 3.5"

The Teac combo is a 3.5" floppy drive and QIC tape backup unit built into 5.25" half height frame. Great for systems with limited drive bays. Tape backup unit utilizes the PC's existing floppy controller. Capacity: 680MB compressed/340MB uncompressed. Tape Format: QIC-3010-MC. Data Trans. Rate: 0.5 & 1Mbps. Tape Media: 3M MC3000XL (400 ft.). Software Incl.: Arcada Backup for Windows 95, Windows 3.1 & DOS (1.44 Meg floppy). (Note: Back-up tape or cables not included with drive.)

FF-3101/700 Combo\$69.99 Ea.

Write in 190 on Reader Service Card.

EZ-EP DEVICE PROGRAMMER - \$169.95

Check Web!! -- www.m2l.com

Fast - Programs 27C010 in 23 seconds

Portable - Connects to PC Parallel Port

Versatile - Programs 2716-080 plus EE and flash (28, 29) to 32 pins

Inexpensive - Best for less than \$200

● Correct implementation of manufacturer specified algorithms for fast, reliable programming.

● Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web.

● Full over current detection on all device power supplies protects against bad chips and reverse insertion.

● Broad support for additional devices using adapters listed below.

Available Adapters

EP-PIC1 (18C5x, 61, 62x, 71, 84)	\$49.95
EP-PIC64 (18C82-5, 72-4)	\$39.95
EP-PIC12 (12C50x)	\$39.95
EP-PIC17 (17C4x)	\$49.95
EP-51 (8751, C51)	\$39.95
EP-11E (88HC11 E/A)	\$59.95
EP-11D (88HC711D3)	\$39.95
EP-16 (16bit EPROMS)	\$49.95
EP-28 (Z80E02, 3, 4, 6, 7, 8)	\$39.95
EP-SEE2 (93x, 24x, 25x, 85x)	\$39.95
EP-750 (87C750, 1, 2)	\$59.95
EP-PEEL (IC722v10, 18v8)	\$59.95
EP-1051 (89C1051, 2051)	\$39.95
EP-PLCC (PLCC EPROMS)	\$49.95
EP-SOIC (SOIC EPROMS)	\$49.95
EP-TSOP (TSOP EPROMS)	\$59.95

Many Other Adapters Available

M²L Electronics

310/837-7818
Fax/BBS: 310/841-6050
3526 Jasmine #4;
Los Angeles, CA 90034
CA orders please add 8.25% sales tax.
<http://www.m2l.com>



BUY • SELL • CONSIGN

WANTED

- Electronic Test Equipment
- Electronics Inventory
- Scientific Equipment
- Mfg. Shop Equip.
- Data/Telco
- Memory

DEXIS

9749 Hamilton Road
Eden Prairie, MN 55344

We Sell

Nationwide!

Call our Fax-On-

Demand System, or our

Internet site for current availability.

Visit our 25,000 sq. ft. showroom warehouse

M-F 9 to 6; Sat 9 to 5

PHONE: (612) 944-7670

INTERNET: WWW.GO2DEXIS.COM

FAX: (612)942-9712 • FAX-ON-DEMAND: 1-800-547-4636 X 300

BRIGAR ELECTRONICS

7-9 ALICE ST. - BINGHAMTON, NY 13904

PHONE: (607) 723-3111
FAX: (607) 723-5202
E-MAIL: BRIGAR2@aol.com

To celebrate our 40th year in business We have increased our credit card discount - the more you buy, the more you SAVE !!!

VISIT OUR WEB PAGE AT
<http://members.aol.com/brigar2/brigar.html>

SERVING: ■INDUSTRY ■SCHOOLS ■HOBBYISTS ■EXPERIMENTORS ■CONSUMERS
OPEN: MONDAY THRU FRIDAY 7:30AM TO 4:30 PM, SATURDAY 7:30AM TO NOON

CREDIT CARD DISCOUNT

\$ 0.00 - \$ 99.99 NET
\$100.00 - \$249.99 LESS 16%
\$250.00 - \$499.99 LESS 20%
\$500.00 - \$999.99 LESS 26%
\$1000.00 AND UP LESS 30%



Send for Free
Catalogue

GEORATOR CORP. = NO BRUSH
FREQUENCY CONVERTOR #39-002
INPUT: 7.5 HORSE POWER, 3 PHASE 60HZ
OUTPUT: 5KVA, 1 PHASE 400 HZ
The "Nobrush" verticle converter is a vertically mounted motor generator set used to convert 80 hz Freq. to 400 hz freq. The lower portion consists of the generator & upper motor. The motor, Generator, Control windings & control electronics are all packed together in a single unit. The motor stator windings, Generator stator and control toroidal windings are mounted within the cast alum housing. BRAND NEW - WEIGHT 290 LB - ORIGINAL COST \$ 5400.00
OUR PRICE JUST \$995.00



Labtec. # LCS-150

Amplified computer speakers
•3" magnetically shielded speakers for monitor, drive and disc protection
•bass boost •single sided speaker control •3.5mm stereo plug connection •power output: 1.35 watts RMS/ Ch., 5.4 W total p.p. •Freq. response 80 - 16000Hz •Built in power booster •Led Indicator •compatible with pc soundcards, CD-Rom players PC & MAC computers. BRAND NEW
Price \$19.95



MULTIMETER

MFG: PHASTRON
Analog meter movement 50 Micro Amp D.C. full scale. Large 4.5" diam - 3.5" viewing area. Zero adjustment knob. White face. Scales: In Green, Black, and Blue letters. Three AC & three DC Volt Scales. 0 - 2.5, 5 and 10. One resistance scale from 0 to infinity. Includes mounting hardware. BRAND NEW - FACTORY BOXED.
REDUCED PRICE \$4.95



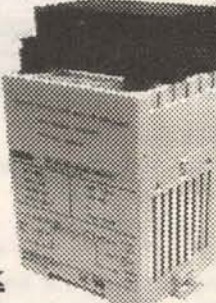
ANALOG PANEL METER
PART # 40-013857

Phoenix contact # CM62-PS-120AC/24

Linear Regulated compact POWER SUPPLY

INPUT: 120VAC
OUTPUT: 24VDC 1AMP
fuse & overload protected.
UL & CSA APPROVED.
SLIDE MOUNTABLE.
Unit includes heat sink
SIZE: 3"W X 5-1/2"H X
2-1/2"D NEW FACTORY
BOXED. MANUALS
INCLUDED.

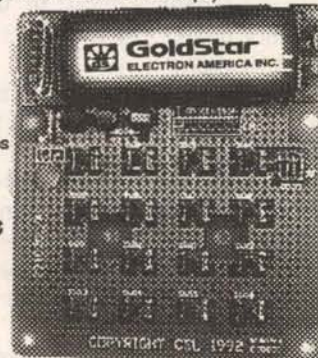
LIST PRICE .. \$259.95
BRIGAR PRICE.. \$59.95



2 x 16 SMART LCD DISPLAY GOLDSTAR

MODEL #LC16208 •Character: 16 •Line: 2 •Power requirement: 5vdc @ 3mA •Window size: 5/8" x 2-1/2" L - 2 goldstar drivers: #GM9120 - Display comes mounted on a 3-3/4" x 4-1/4" circuit board with 16 mini push button switches and 3 rectangular LED'S. (Comes complete with schematics, 68hc11 program and initialization steps)
SALE \$12.95

DISPLAYS COMES COMPLETE WITH 3.5" DISKETTE. FILES CONTAIN 68HC11 PROGRAM, LIST OF COMMANDS, schematics & initialization steps.



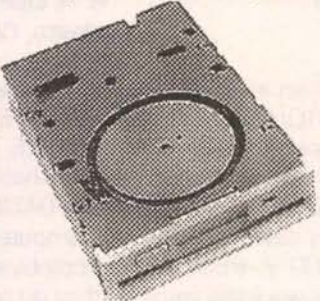
MULTIMEDIA MICROPHONE

Omnidirectional microphone is ideal for voice and sound input into your computer multimedia applications. 6 ft. cord with 1/8" stereo jack. Include stand with tape back for mounting, or mic can be attached to lapel.

BRIGAR SALE PRICE ... \$1.50



3.5" 1.44MB FLOPPY DRIVE
NEWTRONICS CO. # D359T5
5 VDC - WHITE FACE PLATE
FOR USE WITH IBM & IBM
Compatible computers. HIGH
Density. BRAND NEW ... \$19.95

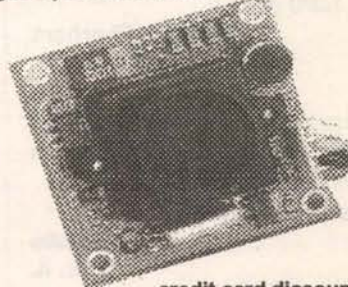


POWER PRODUCTS # HE381
Linear power supply module.
Size: 2-1/4"W x 4-3/4"L x 1-1/2"D
Input: 115vac 50/60hz 271 ma.
Output: 5vdc 5000ma.
Price... \$24.95 ea.



WELDEX Video camera with Audio

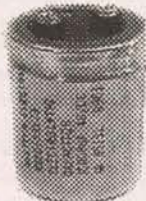
1/3" CCD Board camera # WDPR-2000
B&W Pinhole lens with Audio
compact 30mm x 30 mm (Approx 1"sq.)
High performance & picture quality of a full featured camera on a compact board.
Audio feature (Mic is built on the board)
0.03 Lux min. illumination
430 lines resolution 8-12 VDC input
Brigar Special \$85.95



credit card discount not
applicable to this item

SPRAGUE

Computer Grade
Capacitor
10,000 uf - 40 VDC
Size: 3-1/2" x 2" dia.
PRICE...
\$2.00



BANNER MINI-BEAM #SM312FPHMHS

Self contained DC-operated Visible-red fiber optic sensor. Compact, modulated sensor for 10-30 vdc operation. Useable in opposed and diffused fiber optic modes. Fiber optic sensing is often the answer when there are space or environmental limitations.

- supply voltage: 10 - 30 vdc
- Output config: one current sourcing (PNP) & one Current sinking (NPN)
- Protection: false pulse, polarity reversal, overload & short circuit.
- response time: 1 Millisecond
- Red Led indicator for alignment
- SENSING RANGE: 0.5" TO 10"

schematics and
instructions
included.
PRICE \$69.95



JOHNSON #27120

6-12VDC Toy/Hobby Motor
Miniature - Reversible Dc
motor. 6vdc @ 6000 RPM
12 Vdc @ 12,000 RPM
Size: 1-1/4"L x 1"W x 13/16"
Shaft: 3/4"L x 1/16"Dia.
Price 50¢ ea.
10 For \$4.00



High Q Video Capture Card

Mfg: Hauppauge computer works
Card requires a 16 bit expansion slot. Captures Video in .avi format at various frame rates & size. Frame grabber saves pictures in the following format (.jpg) (.bmp) High Q card will work with both NTSC & PAL Video devices. High Q card will handle up to two Video input devices & audio input devices. Comes complete with software.
Price \$99.95



KATO ENGINEERING MOTOR - GENERATOR

MODEL #100-684341711
Alternator: 100 KW •125 KVA •.8pf •3 phase
•400 hertz •12 wire •voltage 115/200 230/400
•amps 362/181 •Exc field volts 50 •Exc field amps 5.8
Synchronous Motor: 175 HP •1200 RPM •60 Hertz
•3 phase •1.0 pf •code letter F •wire 9 •Volts 480/240
•Amps 184/370 •Exc field volts 100 •Exc field Amps 2.3
Dimensions: 80"wide x 40"deep x 34"high
Weight: 4000 Lbs. SPECIAL SALE \$5,500.00



Credit card discount does
not apply to this item.

HOWARD ENTERPRISES

TELECAMERA #HA4700 COLOR CCD CAMERA

with built in Microphone
CAMERA COMES COMPLETE WITH POWER
ADAPTOR - VIDEO CABLE - SWIVAL BASE
Camera uses a 1/3" CCD advanced imager, automatic gain control, electronic auto iris, fixed focus glass lens, and attractive enclosure - designed for videoconferencing. Real time capability, composite signal output for standard interface to: TV monitors, VCRs, use with video networks, frame grabber compatibility etc
•Scanning system: ntsc (525 vert lines 300 fps)
•sync system: internal sync only
•Resolution: Horizontal TV lines 330
•Max Illumination: 10 lux •NTSC Compatible
•Focal distance: 600mm fixed
•Video S/N Ratio: 46dB
•IRIS System: Electronic auto iris
•CCD imaging: 532h x 500v 270k pixels
•Video output: composite video
•Rear connections: Audio & video RCA jack, AC adaptor jack
•Size: 68.5mm(w) x 43mm(H) x 122mm(D)
BRAND NEW FACTORY BOXED..... \$189.95



SEALED BALL BEARING

MFG: FAFNIR PART # 203 VV
•BORE: .668" •Dia. 1.575" O.D.
•.47" thick
List Price \$7.00
SALE PRICE...
\$1.50



1 MEG 30 PIN SIMM MEMORY MODULE
GOLDSTAR #GMM781000NS70 NON PARITY - 70 ns
BRIGAR SALE PRICE \$4.95



TECH FORUM

This is a READER TO READER Column. All questions AND answers will be provided by *Nuts & Volts* readers and are intended to promote the exchange of ideas and provide assistance for solving problems of a technical nature. All questions submitted are subject to editing and will be published on a space available basis if deemed suitable to the publisher. All answers are submitted by readers and **NO GUARANTEES WHATSOEVER** are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals. Always use common sense and good judgement!

QUESTIONS

Send all material to **Nuts & Volts Magazine**, 430 Princeland Court, Corona, CA 91719, OR fax to (909) 371-3052, OR E-Mail to forum@nutsvolts.com

All the commercial "PIR" motion detectors that I can find will turn on and stay on if the supply voltage is quickly turned off and on. The problem with this is that when I get a momentary power failure, the controlled lights or the other device remains on until I am present to reset the PIR.

Is there a model available that does not behave in this way or a method to defeat this function?

I realize this is done intentionally by the manufacturers as a way to activate the lights via the supply switch. An external turn-off timer is undesirable.

**6981 Coleman Bovender
Greensboro, NC**

What problems (if any) will be encountered in substituting a SI transistor for a GE transistor of similar type/specs. other than base/emitter voltage drop?

Can this be done without major modifications?

**6982 John Pinto
Morgan Hill, CA**

I am interested in building a Theremin. It's a musical instrument. Does anyone have ideas?

**6983 Michael
via Internet**

I have a Magellan 2000 GPS unit. It's had a rough life. All the functions work on it except for the display.

Some of the pixels are not functioning and I was wondering if there is a way to take the system apart in order to do repairs on it myself? (I'm too cheap to pay to get it fixed.)

I have looked everywhere to find some kind of tech manual on it or some clue as to how to take it apart, but all to no avail.

Can anyone help me?

**6984 Darren Moorhouse
via Internet**

I am interested in building a couple of high-power (6 KW) switching power supplies.

The output is variable in the 25- to 40-volt range and the input is from the 230-volt line.

I expect to rectify and filter the AC to provide a \pm DC supply and drive a toroidal transformer with power

MOSFETs or IGBTs.

The secondary needs to be isolated from the primary.

I need information on selecting the proper core and the primary winding to keep the losses reasonable. The switching frequency is estimated to be 200 KHz and controlled by Pulse Width Modulation.

**6985 Mike Beaver
Los Altos, CA**

I want a feedback circuit to "tickle" ordinary quartz crystals at their resonant frequency.

The crystals will range in size from 1/2 of a little finger to 2x the size of a thumb.

I don't even know where or how to hook wires to the crystals. If necessary, I could hang them in water to "connect" them to the power source.

Is there a frequency doubler or quadrupler circuit?

**6986 Dan Martin
North Egremont, MA**

I am a die-hard user of a Commodore 64 computer and have several spare back-ups.

It is all I need for what I do, and I'm still trying to learn all its capabilities.

What I would like to know is how to add a hard drive.

**6987 Anthony Eberhart
Chicago, IL**

My computer screen-saver kicks the screen on and powers it down instead of a sleep mode.

What is the problem?

**6988 E. J. Wells
Joliet, IL**

I am searching for hard/software compatible to the Yamaha CX5M music computer, specifically related to its musical functions.

**6989 M. Reese
Chicago, IL**

I need an analog-digital converter (not a kit or project) that isn't very expensive for radio astronomy applications. Any suggestions?

**69810 Wayne L. Truax
Presidio of San Francisco, CA**

I have come into possession of an impressive looking piece of test

equipment called a Model 505 Waveform Analyzer.

This unit is a model 505-488 manufactured by AUTEK Systems Corp., Santa Clara, CA.

It was surplus from National Semiconductor Co. I do not have the probes nor the manual. I have tried to obtain information on this unit and have not been able to find out anything. The company AUTEK apparently no longer exists.

Does anyone know what it is? Is it something that could be useful to an electronics hobbyist like me? Does anyone know what happened to AUTEK Systems Corp.? Where can I obtain a manual?

**69811 R. R. Dunn
Modesto, CA**

When in GW-BASIC, Alt-A prints out AUTO, Alt-B prints BSAVE, and so on. Looking inside GWBASIC.EXE, I cannot find an occurrence of those strings; yet when I use GW-BASIC with my new Windows 95 computer with DOS 7, those Alt key combinations all work the same as they do on my DOS 3.30 computer.

This is unlike the Alt-*nnn* keypad trick, because it works only when in BASIC. (What is the source of the Alt-*nnn* keypad trick in terms of software? It works in DOS, DEBUG, EDLIN, GW-BASIC, QBASIC, etc.)

The real question is: what is the source of those strings: AUTO, BSAVE, and so on? If it's not inside GW-BASIC, or inside COMMAND.COM, is it inside the BIOS? Why does it all still work with DOS 7, even though the source is not inside GW-BASIC?

**69812 Homer B. Tilton
Tucson, AZ**

I am looking for a circuit for a 0-30V @ 20A power supply, using 2N3055 output transistors (six) and using a 62.5V @ 20.5A power transformer (not center tapped).

**69813 M. Jobe
Marion, IL**

I need a circuit diagram and/or component descriptions suitable in a wide band (100 KHz to 75 MHz \pm 3 dB) amplifier with a gain of +20 dB.

The input impedance is 10 megohms and the output impedance is

ANSWER INFO

- Include the question number that appears directly below the question you are responding to.
- Payment of \$25.00 will be sent if your answer is printed.
- In most cases, only one answer per question will be printed.
- Your name, city, state, and E-Mail address, (if submitted by E-Mail), will be printed in the magazine, unless you notify us otherwise with your submission.
- Due to space limitations, we can not reprint the original questions with the answer. The question number and the issue it appeared in are printed above the answer.
- Unanswered questions from a past issue may still be responded to.
- Comments regarding answers printed in this column may be printed in the Reader Feedback section if space allows.

QUESTION INFO

TO BE CONSIDERED FOR PUBLICATION

All questions should relate to one or more of the following:

- 1) Circuit Design
- 2) Electronic Theory
- 3) Problem Solving
- 4) Other Similar Topics

INFORMATION/RESTRICTIONS

- No questions will be accepted that offer equipment for sale or equipment wanted to buy.
- Selected questions will be printed one time on a space available basis.
- Questions may be subject to editing.

HELPFUL HINTS

- Be brief but include all pertinent information. If no one knows what you're asking, you won't get any response (and we probably won't print it either).
- Write legibly (or type). If we can't read it, we'll throw it away.
- Include your Name, Address and Phone Number. Only your name will be published with the question, but we may need to contact you.

50 ohms.

I've tried several J-FET and Com-linear amplifiers. I am getting 500+ microvolts of white noise at the 50-ohm output when my input is terminated only with 10 megohms and the input cable and device are disconnected to remove the noise generated from the device I want to amplify.

I am looking for methods which will result in less than 100 microvolts of white noise as seen at the output of the +20 dB amplifier.

The noise is primarily in the first stage and is then amplified resulting

TECH FORUM

in the 500+ microvolts of noise which I want to reduce.

I've read Comlinear's noise analysis application notes. Does anyone have any tips on wide band width, high- input impedance, low-noise methods and/or devices? I am using low-noise metal film resistors.

69814 David R. Howland
Santa Cruz, CA

ANSWERS

ANSWER TO #4987 - APR. 1998

The 80287 math coprocessor chip needs no programming — just plug it in and it should be recognized.

You can run MSD.EXE (Microsoft's diagnostic program) to verify that it is recognized.

If it is not automatically recognized, you may have to configure a math coprocessor enable jumper on the motherboard and/or as a BIOS setting.

John McMichael
Laramie, WY

ANSWERS TO #49814 - APR. 1998

Op-amps aren't very good at driving high-power loads like LEDs,

relays, and such. What you want to use is a bipolar transistor like a 2N2222 to drive the LED.

Depending upon the forward current rating of the LED and the supply voltage available, you will need to put a resistor in series with the LED and the transistor.

To calculate this resistor, take the supply voltage, subtract the LED forward voltage, and subtract 0.3. Divide this result by the maximum forward current (in mA) times 0.9 to get the series resistor value in Kilohms. Multiply this resistor value by the square of the LED current to find the power rating necessary (round up to the nearest 1/4, 1/2, etc).

You will also need a resistor between the base of the transistor and the circuit driving the transistor. Calculate its value by the following: subtract .7 from the maximum voltage put out by the driving circuit (probably close to the power supply voltage) and divide by the LED current used in the previous calculation (in mA). Then multiply this result by 100 to get the resistor value in Kilohms.

The circuit is then wired like this: the series resistor (first one calculat-

ANSWER TO #5989 - MAY 1998

The following is a generic listing of printer cable and plug pinouts.

A DB-25 (male pins) plug attaches to the PC printer port and, in this example, a 36-pin Centronics plug attaches to the printer. Parallel Printer Signal Pinout

Printer				PC LPT1			
Centronics Jack				DB-25 Jack			
Pin	Signal	Printer	Port	Pin	Function		
1	Strobe	Input	Output	1	Enables data 1-8		
2	Data 1	Input	Output	2	PTR data		
3	Data 2	Input	Output	3	PTR data		
4	Data 3	Input	Output	4	PTR data		
5	Data 4	Input	Output	5	PTR data		
6	Data 5	Input	Output	6	PTR data		
7	Data 6	Input	Output	7	PTR data		
8	Data 7	Input	Output	8	PTR data		
9	Data 8	Input	Output	9	PTR data		
10	Acknowledge	Output	Input	10	PTR received data		
11	Busy	Output	Input	11	PTR busy		
12	Paper Out	Output	Input	12	PTR out of paper		
13	Select	Output	input	13	PTR on/off line		
14	Autofeed XT	Input	Output	14	Add LF to each CR		
15	Error	Output	Input	15	PTR fault/off line		
16	Signal ground						
17	Chassis ground						
18	+5VDC/NA	Output					
19	Strobe return						
20	Data 1 return						
21	Data 2 return						
22	Data 3 return						
23	Data 4 return						
24	Data 5 return						
25	Data 6 return						
26	Data 7 return						
27	Data 8 return						
28	+5 VDC/NA	Output	Input				
29	Busy Return						
30	INIT return	Input	Output				
31	INIT	Input	Output	16	Reset PTR		
32	Error	Output	Input				
33	Signal ground						
34							
35	+5VDC/NA			17	Notify PTR		
36	Select In	Input	Output	18-25	Grounds		

Stanley Link
San Diego, CA

ELECTRONIC TEST EQUIPMENT BOUGHT & SOLD

Altech 360D11, Frequency Syn. .01-2GHz	\$1,000	HP 8640B/01, Signal Gen., 5-512MHz AM/FM	\$1,000
Argosystems AS210, Frequency Calibration System	\$2,000	HP 8656B, Signal Generator, .1-990MHz, AM/FM	\$3,500
Balco 911A, Frequency Response Analyzer (unused)	\$400	HP 8743A, Reflection Transmission Test Set	\$300
Ball Efratom PC-10, Rubidium Standard	\$800	HP 8748A/H26, S-Parameter Test Set, 4-2600MHz	\$2,000
Bird 4381, RF Power Analyst, Opt. 832	\$300	HP 8754A/H26, Network Analyzer, 4-2600MHz	\$4,000
Boonton 102B, Signal Generator, 45-520MHz	\$650	HP 8755C, Network Analyzer Plug-In	\$500
Boonton 518-A4, Q Standard	\$250	HP 8757A/001, Network Analyzer, Opt. 001	\$5,000
Boonton 82AD, Modulation Meter	\$650	HP 8901A, Modulation Analyzer	\$2,000
Bruel & Kjaer 1612, Bandpass Filter	\$250	HP 8903A, Audio Analyzer	\$2,000
Calif. Inst. 101T, AC Power Source	\$400	Keithley 192, Programmable DMM, 6.5 Digits, HP/IB	\$600
Cushman CE24B, Frequency Selective Voltmeter	\$500	Keithley 614, Electrometer	\$700
Datron 1062, Digital Multimeter	\$300	Krohn-Hite 3202, Filter, LP, HP, BP, Unused	\$350
DR Thiedig MILLI-TO2, Ohmmeter,		Leeds & North 1091, Capacitor Decade, .001uF-1uF	\$150
1 Milliohm-2 Terrahms		Marconi 2022A, Signal Generator, 10KHz-1GHz	\$1,800
Eaton 380K11, Synthesizer, 1-2000MHz		PMI 1018B, Peak Power Meter	\$350
Opt. 01, 03, 183	\$2,500	Polarad 1105 E-L, Sig. Gen., 1020A Mod., 8-2.4GHz	\$300
ESI 296, Auto LCR Meter	\$800	Polarad 1207, Signal Source 3.8-8.2GHz	\$200
HP 8445B, Spectrum Anyz., Automatic Pre-Selector	\$300	Polarad SPNH, Generator 20Hz/20KHz	\$450
Fluke 3330B, DC Voltage, Current Calibrator	\$400	Racal Dana 1515, Delay Pulse Generator	\$500
Fluke 335A, DC Voltage Standard, 0-1100VDC	\$600	Racal Dana 1992, Frequency Counter, High Stab.	\$500
Fluke 515A, Portable Calibrator	\$800	Racal Dana 9082P, Signal Gen. 1.5-520MHz	\$800
Fluke 5200A, Programmable AC Voltage Standard		Racal Dana 9303, True RMS RF Level Meter	\$650
HP/IB	\$1,200	Racal Dana 9515, Universal Counter, HP/IB, Opt. 41	\$200
Fluke 6080A/VAN Frequency Syn., 5-1024MHz	\$5,000	Sanders 5440C, Noise Figure Mtr., 10KHz-40GHz	\$400
Fluke 9010A, Micro-System Troubleshooter Opt. 001	\$450	Sencore TF30, Super Cricket Transistor Tester	\$200
Fluke A55, Thermal Converter	\$200	Tek 1241A, Logic Analyzer, with Accessories	\$650
General Microwave 478A, Peak Power Meter	\$700	Tek 1410, Sync Generator SPG2, Color Bars TSG7	\$650
General Radio 1433G, Decade Resistor	\$350	Tek 1420, NTSC Vectorscope	\$500
General Radio 1433G, Decade Resistor, 1.111111m.	\$300	Tek 1470, NTSC Color Sync & Test Sig. Generator	\$500
General Radio 1531, Strobetac	\$150	Tek 1502, TDR, Opt. 4, Chart Recorder	\$1,000
General Radio 1538-P4, High Intensity Flash Capacitor	\$50	Tek 178, Linear IC Test Fixture, For 577	\$300
General Radio 1633-A, Incremental Inductance Bridge	\$500	Tek 2230, Digital Scope, 100MHz, Dual Trace	\$1,500
General Radio 1650A, Impedance Bridge	\$200	Tek 2235, Scope, 100MHz Dual Trace	\$750
Gigatronics 600/6-12, Synthesized Source	\$1,000	Tek 2336, Scope, 100MHz, Dual Trace	\$800
Gigatronics 900/2-18, Sig. Gen. Sweeper, 2-18GHz	\$5,000	Tek 2432, Scope, Digital, 300MHz, 4 Channel	\$3,000
Goldstar OS-7040A, Scope, 40MHz, Dual Trace	\$200	Tek 2465, Scope, 300MHz, 4 Channel	\$2,500
Gould 4500, Digital Storage Scope, 35MHz	\$300	Tek 305DMM, Scope, 10MHz, Dual Trace, DMM, battery	\$800
Guilidine 9154C, Transvolt Standard Cell	\$300	Tek 318, Logic Analyzer, with Pds & Acc.	\$500
Hitachi V-212, Scope, 20MHz, Dual Trace	\$200	Tek 464, Scope, 100MHz Dual Trace, Storage	\$400
HP 1124A, 100MHz Active Divider Probe, Unused	\$100	Tek 465, Scope, 100MHz Dual Trace	\$400
HP 11638A, Calibration Kit, Type N	\$600	Tek 465M, Scope, 100MHz Dual Trace	\$400
HP 11664A/01, Detectors, .01-18GHz	\$200	Tek 466, Scope, 100MHz Dual Trace, Storage	\$600
HP 11665B, Modulator	\$250	Tek 475, Scope 200MHz, Dual Trace	\$600
HP 11712A, Service Kit for 8670 Series Inst.	\$500	Tek 475A, Scope 250MHz, Dual Trace	\$650
HP 15453A, Pod Set for 8170A	\$200	Tek 485, Scope 350MHz, Dual Trace	\$700
HP 1630G, Logic Analyzer, 65 Ch. 100MHz	\$600	Tek 492/01/02, Spectrum Analyzer	\$4,500
HP 16500A, Mainframe, 16510A, 16530A, 16531A,		Tek 492/01/02/03, Spectrum Analyzer	\$5,000
16520A, 16521A	\$3,000	Tek 492/02, Spectrum Analyzer	\$4,000
HP 16510B, Logic Analyzer Card, 16500A System	\$1,000	Tek 496P, Programmable Spectrum Analyzer	\$5,000
HP 16530A/16531A, Digital Scope Card, 16500A System	\$1,000	Tek 577/177, Curve Tracer	\$1,000
HP 1741A, Scope, Storage, 100MHz	\$450	Tek 5003, Power Module	\$300
HP 1742A, Scope, 100MHz Dual Trace, DMM	\$400	Tek 5A13N, Differential Comparator	\$250
HP 1744A, Scope, Storage, 100MHz, Dual Trace	\$500	Tek 5A20N, Differential Amp	\$100
HP 214B, Pulse Generator	\$1,000	Tek 624, XY Monitor	\$100
HP 2804A, Quartz Thermometer, No Probe	\$300	Tek 7D20, Programmable Digitizer PI	\$800
HP 3325A/01/02, Function Gen. Opt. 01/02	\$2,000	Tek 7S12/S6/S52, TDR Sampler	\$800
HP 334A, Distortion Meter	\$200	Tek CG551AP/515P, Scope Calibrator	\$1,000
HP 3455A, Digital Multimeter	\$300	Tek DC503, Universal Counter Timer TM500	\$150
HP 3580A, Spectrum Analyzer, Opt. 02	\$800	Tek DC504, Counter/Timer TM500	\$100
HP 3581C, Selective Level Meter	\$500	Tek FG502, Function Generator, .1Hz-11MHz	\$250
HP 4270A, Automatic Capacitance Bridge	\$400	Tek FG504, Function Generator, .001Hz-40MHz	\$500
HP 4800A, Vector Impedance Meter	\$600	Tek MR501, XY Monitor Scope	\$200
HP 5004A, Signature Analyzer	\$100	Tek P6046, Differential Probe Kit	\$350
HP 5006A, Signature Analyzer	\$300	Tek P6201, FET Probe, 1GHz	\$200
HP 5334A/010/060, Frequency Counter, Unused	\$1,200	Tek PG508, Pulse Generator, 50MHz	\$300
HP 5335A/030, Frequency Counter, 1300MHz	\$1,000	Tek PS503A, Dual Power Supply	\$150
HP 5340A, Frequency Counter, 18GHz	\$800	Tek S-6, Sampling Head	\$350
HP 5340A/011, Frequency Counter, LEDs, HP/IB	\$1,200	Tek SC502, Scope, 15MHz, Dual Trace	\$250
HP 54001A, 1GHz Active Probe for 54100-54110 System	\$3,000	Tek SC503, Scope, 10MHz Storage	\$400
HP 54100D, Digital Scope, 1GHz		Tek SC504, Scope, 80MHz Dual Trace	\$500
HP 54200A, Digital Storage Scope,		Tek SG502, Sig. Gen. 5Hz-50KHz TM500 Sys.	\$200
Dual Trace, 200MG/S	\$1,000	Tek TDS350, Digital Scope, 200MHz, Opt. 14	\$2,800
HP 6112A, Power Supply, 0-40V, 0.5A	\$200	Tek TG501, Time Mark Generator	\$400
HP 8015A, Pulse Generator, .1Hz-50MHz, 30V	\$500	Tek TM503, Mainframe 3 Slot, TM500	\$100
HP 8165A, Programmable Signal Source,		Texscan SSG2000, Freq. Syn., 100KHz-2GHz,	
.0001-50MHz	\$1,600	AM, FM	\$1,800
HP 8350A/86290B, Sweep Oscillator, 2-18GHz	\$4,400	Vu-Data 5110, Semiconductor Tester, In/out Circuit	\$150
HP 8350B, Sweep Oscillator Mainframe	\$4,000	Wavelek 1045/14139, Power Meter	
HP 8410C/8412B, Network Analyzer		1MHz-18GHz Opt. 01, 05	\$800
w/8411A/Opt. 18 18GHz	\$1,500	Wavelek 1084, Signal Gen. Sweeper, 3.5-4.5GHz	\$300
HP 8411A, Frequency Converters	\$250	Wavelek 185, Sweep Function Gen. .0001-5MHz	\$400
HP 8414A, Polar Display	\$300	Wavelek 1910, XY Monitor, Dual Trace	\$600
HP 8445B, Spectrum Anyz., Automatic Pre-Selector	\$300	Wavelek 3000, Signal Gen., 1-520MHz, AM, FM	\$800
HP 8445B/03, Preselector, Digital Readout	\$600	Wavelek 3001, Signal Gen., 1-520MHz, AM, FM	\$600
HP 8501A, Storage Normalizer	\$800	Wavelek 452, Filter, Dual Hi/Low, 1Hz-10KHz	\$450
HP 8553B, Spectrum Anyz., RF Plug-In, 1KC-110MHz	\$200	Wavelek 7530A, FFT Spectrum Analyzer 0-100KHz	\$650
HP 8554B/8552B, Spectrum Analyzer 141T, 1.2GHz	\$1,500	Wavelek 907, Signal Generator, 7-11GHz	\$600
HP 8556A, Plug-In, Spectrum Analyzer, 20Hz-300KHz	\$300	Wavelek 955, Micro Source, 7.5-12.4GHz, AM, FM,	
HP 8557A/180TR, Spectrum Analyzer, .01-350MHz	\$1,000	Sweep	\$1,000
HP 8558B/180TR, Spectrum Analyzer, .1-1500MHz	\$1,800	Wiltron 560A, Network Analyzer	\$800
HP 8559A/182T, Spectrum Analyzer, .01-21GHz	\$3,000	Wiltron 560-97A50, SWR Autotester, .01-18GHz	\$500
HP 8559A/853A, Spectrum Analyzer, Digital,		Wiltron 610D, Sweeper Mainframe	\$250
.01-21GHz	\$4,500	Wiltron 610D/6237D, Sweep Generator, 2-18GHz	\$800
HP 8565A, Spectrum Analyzer, .01-22GHz	\$4,000	Wiltron 6213D, RF Plug-In, 10MHz-4.2GHz	\$400
HP 8569A, Spectrum Analyzer, .01-22GHz	\$5,000	Wiltron 6219D, RF Plug-In, 2-8GHz	\$200
HP 86222B/H69, RF Plug-In, .01-4GHz	\$1,000	Wiltron 6223D, RF Plug-In, 4-12.4GHz	\$250
HP 86241A, RF Plug-In, 3.2-6.5GHz	\$400	Wiltron 6229D, RF Plug-In, 7.9-18.5GHz	\$300
HP 86260A, RF Plug-In, 12.4-18GHz	\$400	Wiltron 6NFS0, Autotester, 1-1500MHz, for 640	\$100
HP 86290A, RF Plug-In, 2-18GHz	\$1,200	Wiltron 7B50, Detector, 1-1500MHz, for 640	\$100
HP 86290B, RF Plug-In, 2-18GHz	\$1,400		

PHELPS INSTRUMENTS

2631 Hillside Ave., Norco, CA 91760 • 909-279-7347



TECH FORUM

ANSWER TO #49817 - APR. 1998

There are a large number of people programming and hacking the TI-85, because of its cheap cost, ease-of-use, and ease-of-availability.

Researching on the Internet can lead to hundreds, if not thousands, of web pages dedicated to third-party hardware and software for the TI-85 calculator.

Visiting <http://www.ticalc.org> (your Internet headquarters for Texas Instruments graphing calculators) would be a good starting point. This web page consists of product information, third-party software, reviews, message forums, and many, many links to other TI-85 related web sites.

There are also a number of E-Mail mailing lists available on the Internet.

As far as adding more memory to your TI-85, a modifi-

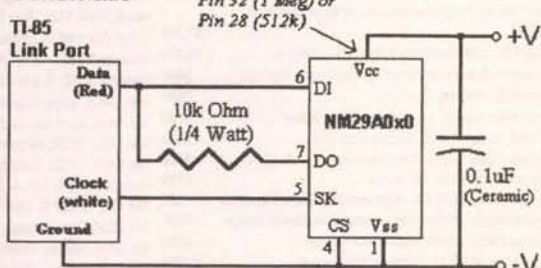
cation has been done that increases the amount of RAM to either 512K or 1024K. The device is known as "The Expander SF" and connects to the 2.5 mm female stereo "link connector" on the bottom of the TI-85.

Detailed construction information, schematics, software, etc., can be found at: <http://www.egr.msu.edu/~tsaimelv/expander.htm>

The schematics for the device, designed by Melvin Tsai [tsaimelv@pilot.msu.edu], can be seen below:

Joe Grand

Expander SF Schematic



ed) is wired between the power supply positive and the anode of the LED (usually the long lead). The cathode of the LED connects to the collector of the transistor (identify the leads with the flat side of the part facing you and the leads down — from left to right — emitter, base, collector). Connect the second resistor to the base of the

transistor and the other end to the driving circuit. Connect the emitter of the transistor to the return lead of the power supply.

Some additional notes: you should optically shield your IR receiver and the transmitter LED to avoid oscillations in your circuit.

Also, you should be aware that

ANSWERS TO #49814 - APR. 1998

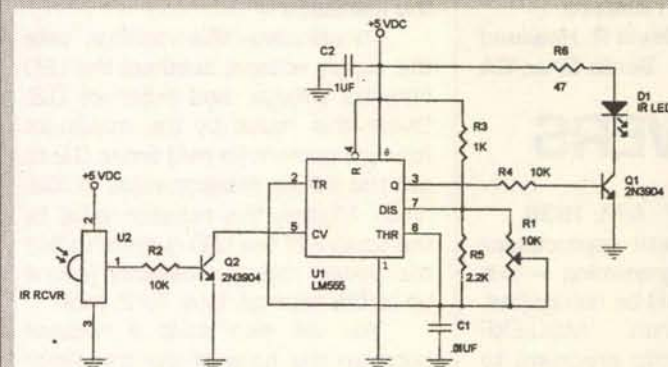
I made the same mistake you did in my first attempt in building an IR repeater.

As it turns out, the binary data from the IR transmitter modulates a 40-KHz carrier frequency which is

removed by the IR receiver. You end up with only the binary command data. You have to re-modulate the binary command data if you want to re-transmit it.

Fortunately, this is easily accomplished using a 555 timer IC configured to oscillate at 40 KHz. With an o'scope or frequency counter on pin 3 of U1, adjust R10 for 40 KHz. See the schematic for construction details.

Kevin Goodwin
Oceanside, CA



the input and output of your repeater must be in phase in order for this method to work. If it still doesn't, repeat, and check to be sure that the LED is off (no voltage drop across the LED resistor) when there is no IR source on the receiver. If it is on when it should be off, then you need to invert the driving signal to the transistor. You can do this by inserting a second transistor and base resistor between the driving circuit and the transistor driving the LED.

Put a 4.7K resistor between the power supply and the collector of the

first transistor and connect the base resistor of the LED transistor to the collector of the first transistor.

Vinny Worley
Fenelon, PA

ANSWER TO #4985 - APR. 1998

The terms "pull-up" and "pull-down" refer to external load resistors that will "pull up" the output of a logic gate or other amplifier output to some desired voltage (i.e., +5 VDC), or "pull down" the signal to somewhere near ground (i.e., 0 VDC).

Pull-ups are typically found in dig-

AUTOMATIC TELLER MACHINES

ATM crimes, abuses, vulnerabilities and defeats exposed! 100+ methods detailed, includes: Physical, Reg. E, cipher, PIN compromise, card counterfeiting, magnetic stripe, false front, TEMPEST, tapping, spoofing, inside job, vibration, pulse, high voltage - others, con jobs. Histories, law, security checklist, internal photos, figures. Much more! \$39.

CELLPHONE PHREAKING GUIDE

How cellphones operate and are modified. Vulnerabilities to hack attack and countermeasures. Details on program. NAMs, ESNs, etc (cloning), control data formats, computing encoded MINs, ESNs, SIDHs, operating systems, PROM program., forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming, Step-by-steps to keypad-reprogram. 100+ popular cellphones. More! \$49.

PAGER / BEEPER MANUAL

How Pagers work, different types and uses, freqs, advantages over and uses with cellphones, and tips and tricks. How Pagers are hacked/countermeasures. And plans for a Personal Pocket Paging System (xmitter and receiver). More! \$29.



MAIL \$3 FOR OUR LATEST CATALOG TO: (\$1 w/ Order)

CONSUMERTRONICS

2430 Juan Tabo, NE, #259, ABQ, NM 87112
P.O. Box 23097 ABQ, NM 87192

505-237-2073 (9-5, M-F) NOTE: Take \$2.00 OFF all New Orders over \$20 placed by Mail or Fax

Full online Catalog: www.tsc-global.com/consumer.html

Fax: 505-292-4078 (all hours, orders only) Web Adventure: www.tsc-global.com

Established in 1971. Featured on CBS "60 Minutes," Forbes, New York Times. Add \$5 total S/H (US, Canada).

Sold for educational purposes only. Postal M.O. is fastest. VISA, MC OK. COD add \$7.

See Catalog for LIMITED WARRANTY, SPECIAL PROJECTS and all other Policies.

PHREAKING CALLER ID & ANI

How they work and dozens of ways of defeating Caller ID, ANI, *69, *57, Call Blocking, *67 etc. Describes ESS, SS7, CN/A, CAMA, DNR, Diverters, Centrex - more! \$19.

SECRETS OF SOLDERLESS BREADBOARDS

100 MHz from SB designs? Major firm offers such boards! SBs are excellent for many final and permanent circuits, and for many RF, Hi-V and Hi-I circuits! And much safer to health and environment. Comprehensive. Dozens of tips! \$29.

HACKING THE INTERNET

The latest tricks and methods being used on the Net to pirate software (warez) and the newest hacking websites. Updated every two months. Includes examples, countermeasures, password defeats, UNIX, Sprintnet, brute force methods, lots of tips, and more! \$29.

COMPUTER PHREAKING

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS, etc are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary FLUSHOT+ protection system. Internet advice, password defeats, glossary - much more! Manual + PC Disk! \$39.

MANY MORE TITLES!

- Hacking Fax Machines - \$29
- PBX Hacking - \$19
- Voice Mail Hacking - \$29
- Beyond Phone Color Boxes - \$29
- Hacking Answer. Machines - \$19
- The Hacker Files - \$39
- Internet Cons & Scams - \$19
- Internet Tracking & Tracing - \$29
- Hacking the Internet - \$25
- Cookie Terminator - \$19
- Beyond Van Eck Phreaking - \$29
- Casino Hacking - \$25
- Credit Card Scams - \$29
- Cons & Scams - \$29
- Social Engineering - \$29
- Polygraph Defeats - \$25
- By an Order of the Magnitude - \$49
- Ultimate Success Manual - \$19
- Stealth Technology - \$19
- Secret & Survival Radio - \$19
- Secret & Alternate IDs - \$15
- Rocket's Red Glare - \$29
- High Voltage Devices - \$29
- Mind Control - \$29
- Under Attack! - \$29
- Radionics Manual - \$29



SPECIAL PROJECTS

We will design & build just about anything! Ask for our free SP Application Form! Hardware now done as SPECIAL PROJECTS only

THE DIRTY-2 DOZEN

24+ Hacker-type Disks. See CATALOG!

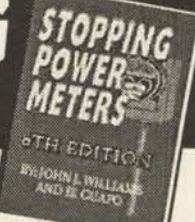
STOPPING POWER METERS

As reported on "60 MINUTES"! All-new 6th Edition! Over 45 pages jam-packed with how devices can slow down (even stop) watt-hour meters - while loads draw full power! Device plugs into one outlet and normal loads into other outlets. Describes meter creep, overload droop, etc. Plans only! \$29.

THE I.G. MANUAL: External magnetic ways (applied to meter) to slow down and stop power meters while drawing full loads. Plans \$25.

KW-HR METERS: How watt-hour meters work, calibration, error modes (many), ANSI Standards, etc. Demand and Polyphase Meters. Experimental results to slow and stop meters by others. \$25.

All 3 (above), Only \$59! (Add \$20 for SPM Video)



ORDER TODAY! \$29 SPM THE VIDEO!



Now its easier to learn about KW-HR Power Meters than ever before! This educational video shows you how they work and their anatomy. Demonstrates SPMEM device and external magnetic methods used to slow and stop meters! Hosted by a top expert in the field. From the novice to the pro, an excellent source of info on these exciting devices! Great in combo with our SPM related manuals!

Only \$49 for SPM video + SPM manual!

TECH FORUM

ANSWERS TO #49814 - APR. 1998

There are a couple of ways to handle this situation depending on the characteristics of the IR signal that you want to repeat.

Most IR signals are modulated with a 40 to 50KHz squarewave signal. The high-frequency squarewave signal is turned off and on to convey the binary data. The most common way to repeat these signals is to demodulate the signal to base band then use the resulting binary code to key another IR transmitter, usually consisting of something like a 555

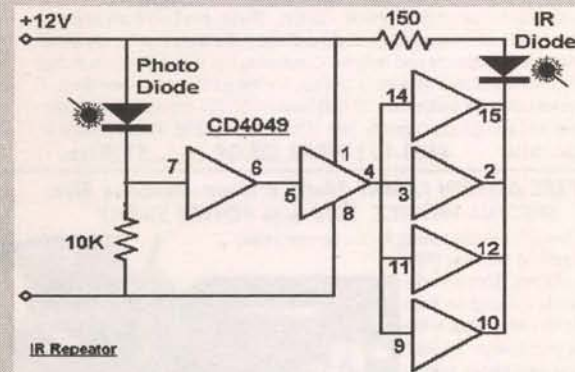
oscillator driving an IR diode. The 555 must be set to the same frequency as the incoming signal.

However, a much simpler way is to simply amplify the incoming signal, complete with the 40 to 50KHz modulation and use it to directly drive another IR diode. This allows any IR signal to be repeated regardless of the modulating frequency. This can be done by using a CMOS CD4049 hex inverter.

Feel free to play with the 10K resistor to adjust the sensitivity. The 150-ohm resistor can be adjusted to set the current into the transmitting IR diode.

Note that four gates are connected in parallel to drive the transmitting IR diode. This will allow long runs of two-conductor cables between the CD4049 and the IR diode as indicated in your original drawing.

John K3PGP
via internet



ital circuits where you want the input of a logic gate to always be at a logic high:

+Vcc (typically +5 VDC)
R (typically 1K to 4.7K)
— gate input

They are also seen on the outputs of gates for "noise immunity," especially where you need to guarantee the output is at a "logic high" until it switches to a logic low. In these cases, the resistor will be around 4.7K to 10K to ensure the driving gate can drop the voltage level to a good "logic low" (<0.8 VDC) when necessary.

"Pull-down" resistors are similarly used to ensure an input is "held to ground."

— gate input
R (typically 220 ohms)
GND

There is a special situation where both resistors are used in a receiver configuration to terminate a long signal run from a driver chip:

+Vcc (typically +5 VDC)
R (typically 330 ohms)
from driver — gate input
R (typically 220 ohms)
GND

This configuration reduces noise on the driver line and ensures distinct logic level changes from the driver.

In terms of calculating pull-up and pull-down values, simply apply Ohm's Law for a voltage divider. Note: make sure your driver can source the necessary current for a pull-down or sink the amount of current with a pull-up.

The typical pull-up values in TTL

digital circuits are 1K to 10K, depending on how "hard" you want the pull-up to be.

For pull-downs, 150 to 330 ohms is what is typically seen. Remember, a pull-down has to do more work than a pull-up because you have a direct path to signal ground with a pull-down, so make sure your driver circuit can handle the current draw across the pull-down resistor.

Ken Simmons
Auburn, WA

ANSWER TO #5982 - MAY 1998

MACLINK to Z88, Macintosh to Z88, cable, program, cartridge, are available for \$25.00. PCLINK to Z88, PC to Z88 cable, program, cartridge,

Continued on page 62

WHITE-STAR ELECTRONICS

TEL: 405-631-5153

FAX: 405-631-4788

CONVERTERS:	20	50	100+
Regal CR-83 (RAN).....	45	39	35
Panasonic TZPC-175 (RAN)	75	69	
Centurion CF-3000 (NEW).....	65	59	55
Regal CR-83 Volume (RAN).....	69	65	59

Call for FREE catalog.
405-631-5153



REMOTE CONTROL

HAND UNITS:	20	50	100+
Jerrold Replaces: 400/450/550.....	4.95	4.50	4.25
Scientific Atlanta: 075/175/475.....	4.95	4.50	4.25
8600: On screen display	7.50	7.00	6.50
Pioneer: BR 81, 82	4.95	4.50	4.25
Panasonic: Call for model #.....	7.50	7.00	6.50
Zenith: All	4.95	4.50	4.25
Tocom: 5503-VIP, 5503-A	7.00	6.50	6.25
Universal: 4 in 1 R/M.....	7.50	7.00	6.50

Call for Oak, Hamlin, Regal-83, Regency, Texscan, and all others.

Tamper-Bit tools: (10-lot)

Jerrold compatible bits:

1/4" Stacom Bit

Oval Round D

Torx Bit:

Tocom T-8

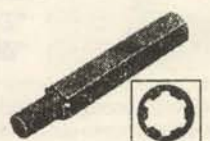
Zenith T-10,T-15

Pioneer T-20

Scientific Atlanta T-20

Pio 63XX Oval.....

Bit Driver Handle.....



We carry most remote hand units. If you don't find the one you're looking for, we can locate for you.

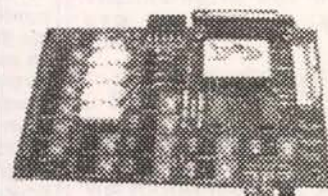
Specializing in large quantities.

HOURS: Monday thru Friday 9 am to 5 pm Central Time.

Call for FREE catalog • E-Mail: WSE405@AOL.COM

Write in 82 on Reader Service Card.

STEPPER MOTOR CONTROLLER



ADDRESSABLE STEPPER MOTOR CONTROLLER: JWPIX-1A

\$199.95

NON-ADDRESSABLE STEPPER CONTROLLER KIT: RENIX-1A

\$29.95

Controls up to 4 unipolar stepper motors per controller with 8 digital inputs with a throughput of 500k bytes / sec. Up to 256 Controllers can be stacked on a single parallel port.

Can be used for the following tasks:

- CNC Conversion
- Robotics
- Positioning Platforms
- Telescope Guidance
- Manufacturing
- Animatronics

PARAMAX INC.
1 (800) 473 - 8080

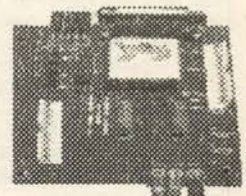
DIGITAL I/O CONTROLLER

ADDRESSABLE DIGITAL I/O CONTROLLER: JWPIX-3

\$179.95

NON-ADDRESSABLE DIGITAL I/O KIT: RENIX-3

\$29.95



8 Bit Digital I/O controller, 8 buffered digital outputs and 8 buffered digital inputs that function at 500k bytes / second. Up to 256 Controllers can be stacked per parallel port.

Can be used for the following tasks:

- Robotics
- Animatronics
- Servos
- Automated Manufacturing
- Controlling Solenoids
- Digital Prototyping

www.paramax.net

Paramax products also available through:
FORD Electronics: (714) 521 - 8080

Write in 83 on Reader Service Card.

Nuts & Volts Magazine/June 1998 39

DANGER! DANGER!

Will Robinson...

SEE in TOTAL DARKNESS! NOT 6 LED's, NOT 12, NOT 24!
OUR IR FLOOD has 168 LED's !! Powerful, not power hungry. Projects up to 50 feet. 24V wall adapter incl. Size: 4.5"Wx6.6"Hx1.5"D
 Commercially made and BRAND NEW!
LEDIR.....\$179ea.

CHECK THIS! ULTRA MINI, WEATHERPROOF and COLOR too!
NEW "COLOR LIPSTICK" camera.
 For those applications that must have color, this unit is for you. Satin black anodized, aluminum, housing is O-Ring sealed & RAINPROOF. Adjustable tilting mount included. Specs: 1/3" CCD, 400 Lines resolution, 1 Lux sensitivity, AGC, Auto Shutter. Operates on 12VDC @180mA, 4.3mm, 78° FOV lens. A real glass lens. NTSC video out. Size only: 32mm diam. X 65mm long. With 24" leads terminated with RCA jack and DC barrel jack. Ready to go! Super nice!
SPECIAL this MONTH, GM-400K....\$279 pwr. adapter..\$4.95

CHECK THIS! ULTRA MINI and WEATHERPROOF
 Our "LIPSTICK" camera sets new standards. Sleek black anodized, aluminum, housing is O-Ring sealed & RAINPROOF. Adjustable tilting mount included. Specs: 1/3" CCD, 380 Lines resolution, 0.3 Lux sensitivity, AGC, Auto Shutter. Operates on 9 to 12VDC @100mA, 3.7mm, 90° FOV lens. A real glass lens. NTSC video out. 1/2 once! SENSITIVE to IR. Ultra small Size only: 23mm diam. X 50mm long. With 36" leads.
GM-200KSTD....\$119 pwr. adapter..\$4.95

"EMBEDDABLE", PINHOLE LENS, "BULLET CAM" it's INCREDIBLE !
 So tiny you can install it right into a door with merely an 0.9" diameter hole. Sleek black anodized, extruded aluminum housing. Similar construction as the lipstick camera above only smaller! 1/3" CCD, 410 Lines Res., 0.3 Lux sens., AGC, Auto Shutter. Power from 9 to 16VDC @100mA, 250k PIXELS, 90° FOV Pinhole lens. A real glass lens. Std. NTSC video out. 1/2 once! SENSITIVE to IR. Size only 23mm Diam. x 35mm long. With 36" leads. Think of the places you could put this little jewel.
GM-200KPH lens....\$129

NEW MICRO CAMERA, w/audio 1/3" CCD,
 410 Lines Res., 0.3 Lux sens., AGC, Auto Shutter. Pwr. from 9 to 12VDC @100mA, 250k PIXELS, Std. model, 3.6mm, 92° FOV lens, Pinhole, 90° FOV. A real glass lens. Both focus from 10mm to infinity. Std. NTSC video out. 1/2 once! SENSITIVE to IR. Size Std: 1.25"sq. x 1"d. PH is 0.6"d. Both with 6" leads. **WARNING:** Don't confuse these models with LOW RESOLUTION, HIGH LUX C-MOS CAMERAS.

GM-1000A-STD.....\$85	GM-1000A-STD/Audio.....\$95
GM-1000A-PINHOLE.....\$85	GM-1000A-PH/Audio.....\$95
GM-1000A-C-MOUNT.....\$85	GM-1000A-CMNT/Audio.....\$95

C-Mount f2.0 Lenses	Micro Lenses for GM1000 series
4mm, 80°.....\$24	2.5mm, 150°.....\$22
8mm, 40°.....\$24	4.3mm, 78° f1.8.....\$22
12mm, 28°.....\$24	5mm, 70°PH.....\$22

NEW GM182, 580 LINE, CCD CAMERA,
 1/3" CCD, 580 Lines Res., 0.1 Lux sens., AGC, Auto Shutter. Pwr. 12VDC @120mA, 3.6mm, 71° FOV. Real glass lens. Focus from 10mm to infinity. Standard NTSC video out. 1/2 once! SENSITIVE to IR. Size: 1.7"sq. x 1"d. with 6" leads. Superior quality for demanding use.
GM182.....\$179ea.

WEATHER RESISTANT Camera Enclosure
 Solid, extruded aircraft aluminum. Glass window. Strain reliefs for cables. Size: 3.5"wx 3.7"hx 1.4"L.
Our Price.....\$59
with 110V HEATER..\$79

Brand New, Video Motion Sensor. Model VM10.
 Attach to any standard video signal and you've got an electronic "watchman" diligently watching the entire scene. Or any adjustable sized area within the scene. Such as a doorway or even a drawer or cabinet. A state of the art security aid. The unit will close a contact when it senses a change. Use it to turn on a VCR or call the hounds. Auto or manual reset. Compact, ac powered. Adjustable sensitivity. Video loop through jack.
NEW VM-10.....\$189.

DIGITAL, COLOR STILL CAMERA, SUPER DEAL!
 We can't mention the famous maker of this quality (\$350 store price) digital camera. You can quickly & easily create digital photos and transfer them to your PC. Ideal for business or home use. Create Web pages, presentations, greeting cards, etc. Selectable resolutions of 640 x 480 or 320 x 240 pixels with 10-bit color. Capacity is 36 high res. or 72 std. res. Specs: 43mm glass lens, built in auto flash 3-10ft., focus free 2 ft. to infinity (and beyond!) Images are std. JPEG. Pwr. by 6VDC. Shutter 1/8 to 1/10,000 sec., Serial cable for downloading of images. Size: 1.9"x5.5"Wx3.1"H. **Cameras are used and have no door on the 4AA battery compartment.** Make your own or use the external std. DC pwr. connector. Includes DOS driver for saving images to PC disk. Requires 486 or better, 16megs RAM, VGA monitor and standard image viewing software not supplied. All cameras have been tested for operation.

DIGITAL CAMERA SPECIAL.....\$149
4 HEAD TIME LAPSE VCR, Records 24 + HOURS!
 Used, depot refurbished, late model VICON model 424's at only 1/3 of the regular price. On screen programming, time/date stamp, audio, index search, power loss recovery and alarm inputs. Excellent working condition. **VICON 424.... \$499**

MOTORIZED PAN and MOTORIZED TILT,
 Now you can remotely PAN and TILT your video cams. Vicon model 3030 indoor units are NEW and operate on 24VAC provided. The complete system includes Pan & Tilt controller with internal power supply. Hookup info included. Max load 7.5lbs. Size: 5.25"W x 5.25"L x 5.25"H Approx. -10, +50 deg. of tilt. A commercial quality unit.
VICON 3030.....\$249

Please fax us your list of unique surplus material.

Exclusive "LAB STYLE" LASERS, 650nm or 635nm, Rugged and dependable. Year warranty. Adjustable X & Y beam position. Aircraft aluminum housing. Internal battery and on-off switch included. Also a super pointer. .75d x 2.75"L
650nm \$69,
635nm \$99

ULTRA PRECISE LINEAR STAGE from KENSINGTON LABS.
 Model 8500-10, Provides 10" high performance travel. One of the best linear stages available. Highly repeatable and ultra-precise. Surfaces are precision ground resulting in unmatched laboratory-grade quality and performance. The 8500-10 incorporates direct-output metrology for outstanding dynamic performance. A linear glass scale, internally attached to the table, eliminates all drivetrain errors not measurable when an encoder is attached to the motor. This system provides up to 1 µm accuracy over 100 mm. Stages are built from stress relieved 7075 aluminum and include crossed-roller bearings for excellent stiffness, load capacity and lifetime. Combining this with a very low friction preloaded leadscrew assembly and cool running DC servo motor drive provides reliability better than 20,000 hour MTBF. 100 mm/sec maximum speed and 68 kg load capacity. Size: 15"L x 9"W x 2.75"H Regular price > \$5Kea. NEW!
8500-10 LINEAR STAGE\$1595ea.

FREE ARGON LASER? 16mW Brilliant Tourquoise Blue, SPECTRA PHYSICS, 161B with POWER SUPPLY
 Our low price is like paying for the power supply and getting the laser FREE! The 488nm, TEM00 mode is nearly 10X brighter than a 16mW HeNe! This is the laser you always wanted but couldn't afford. Perfect for that kick butt light show! All are in good, plug and play condition. Standard 115VAC operation. Integral fan cooling. We priced the whole system for less than others charge for the power supply alone. Why spend more? Always in demand. Limited Quantity. Buy now and be ready for the FOURTH of JULY.
New Price...\$5K+ Special ONLY.....\$799 Complete

TWO MINI C-MOUNT CAMERAS, The super sensitive, GM410 or the general purpose GM412. The GM-412 specs: B&W, size 1.5"sq. X 2.4"L, 250,000 Pixels, 380 Lines Resolution, Sensitivity 0.3 Lux, The GM410 specs: size only 1.5" SQ. x 1.6"L, >270,000 Pixels, 410 Lines Res., Sens. 0.05 LUX., Both cameras are 1/3" CCD with AGC & Electronic shutter. 12V @110mA power. NTSC out. IR SENSITIVE, GM 410 has RCA video connector, GM-412 has a BNC. Both use std. DC pwr. jack. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform ANY camera in this magazine. Multi- lens options are available to exploit their superior performance.
GM412 less lens\$119ea. GM410 less lens...\$169ea.
Fast Lenses for Low Light or General Purpose Normal Light
 16mm, f1.6, 15° FOV\$39
 8mm, f1.3, 30° FOV\$49
 4mm, f1.4, 56° FOV\$49
 4mm, 80° FOV\$24
 8mm, 40° FOV\$24
 12mm, 28° FOV\$24

SPECIAL! LASER DIODE MODULES, ON SALE THIS MONTH!
SPECIFICATIONS:
 DC Power: 4.5 - 9V, @65mA
 Power out: 4.5mw max.
 Range: 400-800 Meters
 Glass Collimator
 Size: 0.41" diam. x 0.7"L
520nm 5X Brighter...\$39
635nm 10X Brighter...\$59
***635F adj. focus...\$79**
 Shown Actual Size
 The best value for commercial, Subminiature, laser modules. Glass collimating lens provides 1.5mRad performance. (Divergence comparable to HeNe lasers.) Wide input, internal surface mount, 4.5 to 9VDC power supply. Machined brass for excellent thermal characteristics.

\$5000 HI-TECH SURVEILLANCE SYSTEM
 • **MOTORIZED, 6X ZOOM LENS**
 • **MOTORIZED, 360° CONTINUOUS PAN**
 • **MOTORIZED, TILT up to 90°**
 • **PHILIPS HIGH RES. 1/2" CCD CAMERA**
 • **OPAQUE BLACK INNER DOME**
 • **CLEAR ACRYLIC OUTER DOME**
 Walk into any major dept. store and you will see these fully integrated systems. From the same mfg. who supplied the Atlanta Olympics! These late model, new in the box systems are virtually ready to use. All you add is power. Philips B&W CCD camera, 450 lines res., 0.5 Lux sensitivity! Their best grade CCD. Anodized aluminum construction. Camera plus Pan & Tilt are powered by external 24VAC via the included Pan & Tilt controller. Motorized, Zoom, Focus and Iris Controller also included. Size of dome: 14" diam. Includes mount for drop ceiling.
COMPLETE SYSTEM with P/T and Zoom/Focus/Iris Controllers....\$995ea.

WORLDS SMALLEST ... 100mW ... VIDEO TRANSMITTER,
 Incredibly only 0.98" x 0.8" x 0.037" in size. Transmits crystal controlled hires. images with 100mW output! The transmitter you've been waiting for. **Shown actual size.** Much smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned ready to receive on cable channel 59. Will work with color or B&W cameras. UHF Bow tie antenna with balun and 3' F cable for TV Included. Perfect with our GM1000A cameras. Both will fit in a cigarette pack...with the battery! The best deal anywhere.
TVX-100...\$199. with GM1000A-PH CAM...\$279.

END FIELD of VIEW GUESSWORK with this, 3.5 to 8mm VARIABLE FOCAL LENGTH LENS.
 Brand New, super f1.8 lens allows you to smoothly adjust from a 97°FOV @ 3.5mm to a 44° FOV @ 8mm. Now you can frame your area of interest just the way you want it! Or use it as a tool to select a fixed lens of the proper field of view. Either way a handy item to have. Standard C-Mount with adjustable focus and iris. **SPECIAL.... \$99ea. or 2 for \$189**

HAM GEAR FOR SALE

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

MOTOROLA GP-68 VHF (136-174MHz) or UHF (430-470MHz) commercial handheld 20 ch., DTMF keypad, PL/DPL, rapid 3 hours desktop charger 1200mAh battery, user programmable only \$295 ea. E-Mail: info@nsiradio.com Tel 253-946-2426 Fax 253-946-8311. NSI Communications, Inc.



VACUUM TUBES, thousands in stock NOS, (new old stock) and high quality low mileage pre-owned tubes. All used tubes cleaned, tested, and boxed before shipment. LynTec 408-274-3559 <http://www.lyntec.com> Lynn@lyntec.com

NEW PRODUCTS FROM S&S: UPGRADE YOUR OLD RIGS! Digital dial (counter) has 10Hz resolution HF, 100Hz VHF and frequency range 50KHz to 230MHz; kit \$99.95; assembled \$149.95. **NEW digital VFO** with 1Hz resolution to 54MHz; kit \$169.95; assembled \$219.95. S&S \$7 (continental US). **GUARANTEED TO WORK.** For info send SASE. Call/write to order: S&S Engineering, 14102 Brown Road, Smithsburg, MD 21783. 301-416-0661. E-Mail: N3SAD@aol.com or see <http://www.xmetric.com/sseng>

MOT UHF Maxors on GRMs \$55 powers supplies & scanners & CB & Ham. Free catalog, call 909-873-1319 or fax on demand 24 hrs. 909-820-1885. E-Mail: HRH6@aol.com & LML, 424 E. Shamrock, Rialto, CA 92376.



THE SMART BATTERY CHARGER for lead acid or gel cell batteries. Can be left connected to the battery **INDEFINITELY**, will not overcharge! Standard kit is 12V @ 1 amp. This kit is 100% complete. For the kit order #150-KIT at \$59.95. For an assembled and tested unit, order #150-ASY at \$79.95. CA residents add 7.75% sales tax. Add \$6.50 per unit shipping. MC/VISA accepted. A&A Engineering, 2521 W. La Palma #K, Anaheim, CA 92801. 714-952-2114, FAX 714-952-3280.



MIKEMASTER: A microphone preamplifier with noise gating & compression. Created by Marv Gonsior W6FR, March 1998 QST. Got noise get MikeMaster! For kit order #210-KIT at \$69.95. Assembled & tested (specify Kenwood, ICOM, or Yeasu wiring) order #210-ASY at \$89.95. Shipping for US & Canada is \$6.50, others add 15%. CA residents add 7.75% sales tax. For info send legal size SASE to A&A Engineering, 2521 W. LaPalma #K, Anaheim, CA 92801. P 714-952-2114, Fax 714-952-3280.

FOR MOON bounce and radio astronomy auto-track antenna mount pedestal precision heavy duty formerly used on SCR 584 radar. Cheap. Tucson, AZ. 520-747-0507.

HAM GEAR WANTED

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

CB - SCANNERS

BLACK BOOK CB LINEARS. Repair notes, theory, specifications, 60 schematics. \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

ORANGE BOOK SCANNER REPAIR. Fix 500 models, modifications. \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

LORD/WYATT COMMUNICATIONS IMPORT/EXPORT RADIO HOBBYIST CATALOG. Everything for the CB & RADIO HOBBYIST from SOUP TO NUTS. Send \$5 to LWC, PO Box 30128CBNJ, Brooklyn, NY 11203-0128. 718-789-7329 press ext. 1.

KONNEX DISTRIBUTING. Call 1-888-777-7874. PO Box 451372, Los Angeles, CA 90045. CBs, antennas, meters, transistors. Best prices. Credit card acceptable.

CB MODIFICATIONS! Frequencies, books, kits, high-performance accessories, plans, repairs, amplifiers, 10-meter conversions. The best since 1976! Catalog \$3. CBCI, Box 31500NV, Phoenix, AZ 85046.

PAT'S ANTENNA SALES. Authorized antenna dealer. Best prices on Jo-Gunn, Signal Engineering and Wilson antennas. Call 218-969-0098 or visit our website at www.suresite.com/mn/a/antennas

240+ CHANNEL CB/HAM/COMMERCIAL radios: AM/FM/SSB/CW export/domestic: RCI, Motorola, Uniden, Cobra, Alinco. Mics, antennas, linears, meter, books, night scopes, and tons more stuff! Catalog \$3. MAXTECH, Box 8086, New York, NY 10150. 718-547-8244.

SUPERSTAR, GALAXY, Mirage, Uniden, Cobra, microphones, power supplies, scanners hard-to-find products, picture price sheets. \$1 to cover postage (REFUNDABLE). Galaxy, Box 1202, Akron, OH 44309. Over 10 yrs. in business.

RED BOOK CB MODIFICATION. Audio, modulation, PLL/VCO, synthesis, crystals, sliders. \$25. Ken's 2825 Lake, Kalamazoo, MI 49001. 616-345-4609.

MUSIC & ACCESSORIES

COMPUTER HARDWARE

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.



19" RACKMOUNT PC chassis: Heavy duty, 4U, 8 slots expandable to 12, two (one hidden) 3.5"/two 5.25" drive bays, front panel fan, mini tower power supply not included, \$189 with this ad! Monitor chassis \$269, keyboard chassis \$139. 8255-8253 I/O card with prototyping area \$69, 12-bit ADDA card \$89, both with software. **Computronics Technology**, 972-242-8087.

UPS SLIMLINE, 400 VA sinewave, \$30 ea. qty 5. Pikul & Assoc. 314-937-0335.

ROGER'S SYSTEMS SPECIALIST. SCSI fast wide cables, ten Base T cables and hubs, bi-directional 1284 I-EEE printer cables, micro-centronics type \$1.50. 9 ft. modem cable \$1 each. Pentium ball bearing fans \$2 ea. Hundreds of items. Call for catalog. Most orders shipped same day. Visit our web site www.rogerssystems.com 1-800-366-0579.

NEW BOOKS!



Build, Upgrade, Repair YOUR COMPUTER!
2nd Edition
Mike Harris

180pp, lay-flat, large format, \$24.95
Exactly what you need to know to save a ton of money, and get precisely what you need and want from a computer. This illustrated book has it all: parts sources, construction details, troubleshooting, and much more.

CREDIT POWER

John Q. Newman.
164pp, large format, \$19.95



Information never before available to the public, including some techniques that might be *illegal* but work! You'll get all the tools you need to manage the image of your credit that the world sees. *A super repair guide!*



RADIO MONITORING

Skip Arey, N2EI
334pp, \$19.95

Global history is made every minute, and now you can listen to it

LIVE! This terrific new book will teach you how to capture radio signals from down the street, across town, around the world, and even from space. The most comprehensive book on scanning — for experts and beginners alike.

Index Publishing Group
3368 Governor Dr, #273N
San Diego, CA 92122-2936

\$4.75 1st book, then \$2.50 each
Credit Card Orders
1-800-546-6707

Write in 53 on Reader Service Card.

Quality ELECTRONICS

Yes, we can help with all your cable needs

QUALITY PRICES

QUALITY SERVICE

QUALITY PRODUCTS

1-800-394-3043

9am-5pm M-S • Same Day Shipping

1 FULL YEAR GUARANTEE

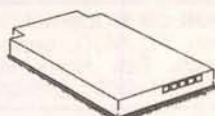
CALL TODAY!

NO NV SALES

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

MACINTOSH SYSTEMS, repairs, parts and peripherals. Low prices on new, refurb, and used Macs and peripherals and all Mac parts. Repairs of whole units or repair or exchange of parts. Mac Shack 716-377-9230, FAX 716-377-9573. Visa/MC accepted. www.servtech.com/public/macshack

CRTs CHEAP. Buy direct from the manufacturer. Save money. Mfg. all CRT types since 1950. **3 year warranty.** Reg-Res 19" tubes \$75; 25" \$100; hi-res 13" tubes from \$80. We specialize in **hi-resolution** video/computer CRTs. **T.M.C.** 215-226-0749/215-223-0388.



ZENITH LAPTOP BATTERIES "NEW." Mastersport ZA-4-1 \$50. Supersport 2.5 amp-hour for ZWL 184 "NEW" \$30. Many other parts. Surplus Trading Corp., Benton Harbor, MI. 616-849-1800.

EVERYTHING NEW, warranty! Motherboards w/CPU + 256K cache, P233 MHz MMX \$195, gigabyte hard drives \$95. 15"/17" SVGA monitors \$175/395. Pentium Class systems from \$450. Also multimedia kits, hard drives, scanners, printers, SCSI adapters \$25/45. Memory, cases, etc. Call for monthly specials. CCI 714-778-0450. E-Mail: cci@net999.com

HEWLETT PACKARD Deskjet 500 printer (qty.), \$79. **HP 7550A** (autofeed, A-B size), \$99. **HP 7475A** plotter (8.5x11"), \$75. **QMS 810** Laser Postscript printer (8 ppm), \$295. **Compaq** SVGA monitor, \$99. Accept Visa, MC, AMEX, C.O.D. Call Maple Data 908-964-7070.

MONITOR REPAIR TECHNICIAN. Start up kit \$69.95 and up. Basic software \$25.95. Business, customers, where and how. USA, all foreign countries, ok. Internet: <http://crtpremiumtekk.cncoffice.com>



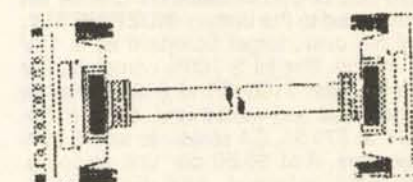
THE SMALLEST AND COOLEST, FULL IBM PC EVER MADE! Yours for \$649! Cost was \$4,000. People are amazed when they see it! Extremely well made. Weighs only 2 pounds! Measures 9"x5.5"x1.37"! Take it wherever you go! Runs any application for DOS or Windows 3.1. Windows for pen computing has animated icons & sound annotation with a cool female personality. Only a few available, so don't wait a single day. Built-in handwriting recognition and on-screen or external keyboard. Electronic pen acts as a mouse and doesn't need to touch the glass screen to move the cursor! 486/25 with 4 meg RAM and 80 megabyte capacity. Razor sharp 6" mono screen 640x480/1 meg VGA touch screen, built-in speaker, parallel/serial/ext. monitor, outputs. Includes: electronic pen, battery, glove leather case, AC supply, compact external keyboard is the same size as the computer. Small external half inch high 1.4 floppy. Books and software. Netcom 1-800-733-3733 ext. 6300.

TRS-80 MODELS 1, 3, 4, 100, pocket computer, COCO. #10 SASE, 55¢ stamp, for list to: TRS-80 AGAIN, 2073 Co. Rd. 127, Fort Payne, AL 35967. E-Mail: petebum@aol.com

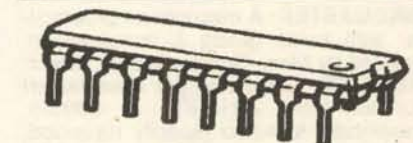
LOW-COST CNC write: motivity, Attn. Pam, PO Box 428, Rocklin, CA 95677. Call 916-349-8757. Info/pictures at www.motivityusa.com A great place to buy CNC.

IBM P233 MHz multimedia systems, Gigabyte hard drives, liquidation price \$595. AT&T Pentiums \$650, 386 systems \$295. Laser printers \$275, color inkjets \$135, color notebooks \$650, closeout prices on software. Call 714-778-0450.

FREE SHIPPING w/Visa. Internet mouse \$6.95, SVGA monitors \$145, flatbed scanners \$75, FAX modems w/sound cards \$25, 386SX40 \$25, 1.2/1.44 floppy \$20, Adaptec SCSI controllers \$45. 714-778-0450.



NORTHWEST CABLE and Connector Co. Your source for computer, network, and telecom cables, connectors, adapters, switchboxes, and related hardware. Examples: SCSI3 cable, HPDB68M/M, 6 foot, \$30; 7 foot UTP patch cable, \$3; RJ11 plugs, \$0.06; RJ45 plus, \$0.12. No minimum order. Deep discounts to wholesalers. Visa/MC/COD accepted. Call 360-754-3606, fax 360-754-0825, or visit www.olywa.net/lor elec/nccc



WANTED: EXCESS ELECTRONIC INVENTORIES, ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 562-494-4851 OR FAX 562-494-4913.

Intermittents? No Sweat.

Let the CDT-4 listen for you!

Automated testing for CD players, CD ROMs, Audio equipment, complex audio installations or any analog signal path.

Simply connect the CDT-4 Automated Audio Tester to the line or speaker outputs and let it record when, where and the type of intermittent that occurred.

CD Players/CD ROMs/Amplifiers/DATs/Computers/Tuners/Preamps/Receivers/
Signal Processors/Mixers/Equalizers/VCRs



To order: 1-800-942-8009 or
www.Sound-smith.com

The SoundSmith Corp.
8 John Walsh Blvd. Ste. 417
Peekskill, NY 10566



Fax: 914-739-5204

PENTIUM MOTHERBOARDS, TX pro chipset, 1MB pipeline cache, 3 ISA/4 PCI, sound on board, or SIS chipset, 512K, AGP, 2-year warranty, \$85. **CPUs:** Pentium MMX: 200/233 @ \$129/179; IBM/Cyrix 200/233 MX \$79/109; **AMD K6 MMX** 200/233/266 @ \$113/141/199; 24X **CD-ROM**, audio button \$59; 72-pin **SIMMs**, 60ns EDO, 16MB \$25; 32MB \$48, S3 **Virge DX** 2MB video card \$35; 4MB GX \$49. Call for current pricing, other parts and illustrated catalog, faxback catalog pages, minimum 1-year warranty, tech- specialties, Inc., 5703 Heffernan, Houston, TX 77087-4113, 1-800-864-5391 for orders and tech support, fax: 713-307-0314, Internet: www.ts.nu

NEW "All-In-One" 486 mainboard with DX2-50 or 66 CPU (upgradeable) 128K cache 1Meg Video and IDE I/O (and all the cables) for \$55 or \$70 (also available without CPU for \$45). Fits in a standard PC case. 16 30 pin SIMM sockets. Win95, OS/2 and Win3.XX video support. Video chipset is Video7. Uses 386, 486DLC, 486SX, 486DX and 486DX2 CPUs. This board is also available in a generic desktop case (235 watt supply) as a bare bones system for only \$80 (DX2-50). Call Under The Wire Electronics (UTWE) 626-930-1121 (10am-5pm Pacific Time) or fax 626-930-1123. UTWE, 235 E. Colorado Blvd. #211, Pasadena, CA 91101. E-Mail: JohnUTWE@aol.com

EXTERNAL SCSI cases with power supply for CD-ROM, tape, hard drive, etc. Includes 2 Centronics 50 pin connectors and internal cables, power LED, power cord, etc. Used, but in great condition, single device case \$29. 4 device case NEW/used \$90/\$50. Great deals on external SCSI cables too! Call Under The Wire Electronics (UTWE) 626-930-1121 (10am-5pm Pacific Time) or fax 626-930-1123. UTWE, 235 E. Colorado Blvd. #211, Pasadena, CA 91101. E-Mail: JohnUTWE@aol.com

LOOKING FOR cheap clone PC parts that actually work? Call UTWE for CD-ROMs, hard drives, disk controllers, video cards, mainboards CPUs, etc. Large and small quantities OK. 100MHz Pentium mainboard (upgradeable to 166MHz) and Intel CPU with 256K cache \$115. 2 Meg (expandable to 4) PCI video cards \$25. Call 626-930-1121 (10am-5pm Pacific) or fax 626-930-1123. E-Mail: JohnUTWE@aol.com

SONY/AMIGA/IND. MULTISCANS 15" 0.26 DP 15.7 (NTSC) thru 36KHz (1024x768). \$150. Blem SVGAs \$110. Others available. Expert Sony repair, parts available. Refurbished. Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

MONITOR ADAPTERS. Convert OEM. (incl. PGA) 31.5KHz & above monitors with BNC connectors to PC use. Model VA10 VGA to RGB+ Sync \$45. Model VA11 VGA to R G/Sync B \$55. VA12 VGA to PGA (DB9) \$45. Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

CD DUPLICATOR: MediaFORM Genesis 2601. Duplicate or master up to 25 CDs at a time. Accepts most CD formats. GearHead Electronics, PO Box 413, Williamsville, NY 14231-0413, 716-636-4370. http://www2.pcom.net/gearhead

28.8BPS MODEMS \$39! CD-ROM drives \$61; (24X) 256K SVGA cards \$10; 3D sound cards \$19.95. Order from this ad by calling 617-823-2985 or log on to our website @ www.beachradioandcomputer.com for more specials! Visa, MasterCard, American Express and checks all okay.

TANDY/RADIO SHACK Model 1/3/4,1000 Support. Monthly magazine, software, parts, repair. Computer News, POB 50127, Casper, WY 82605-0127. 307-265-6483.

COMPUTER SOFTWARE

FREE IBM DISK CATALOG of quality Shareware and CD-ROMs. **MOM 'N' POP'S SOFTWARE** <ASP>, PO Box 15003-N, Springhill, FL 34609-0111. 352-688-9108. momnpop@gate.net

PALM PILOT™ Users Group. Subscribe to our newsletter and download code via your E-Mail box. \$25 yearly dues. Your virtual membership form is at: rascom@msn.com

SONY PLAYSTATION mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

PLAYSTATION MODIFICATION KIT. Easy installation & allows play of copied backups & imports. Send \$20 to: POB 104, Albertson, NY 11507, www.playstationchip.com

CAM & MOTION SOFTWARE: Z-trace, PCB toolpath, \$299. Plotcam motion, \$149. cmheater@juno.com MSG/FAX 407-452-7197, 407-459-2729 <http://www.megabits.net/ddt>

MOD CHIPS for Sony PlayStation. Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. www.cconusa.com

DOWNLOAD A FREE encyclopedia of circuits at members.aol.com/cybercir

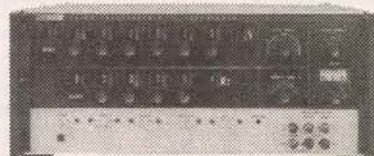
20,000 + TECHNICAL REPAIRS for TVs, VCRs, PROJECTION TVs, CAMCORDERs, AUDIO on disk. **COMPONENT/BOARD LEVEL REPAIRS.** Installs on your hard drive. Easy look-up by model/chassis number. **ADD** your own repairs. **PRINT** out repairs. **Special Sale only \$125.** Send this ad with check. Call or write for **FREE** sample program with over 300 repairs. **HIGHER INTELLIGENCE SOFTWARE, 60 FARMINGTON LANE, MELVILLE, NY 11747. 1-800-215-5081.**

FREE HACKING/phreaking/trubblemware diskette catalogue. Incredible subject matter. No commercial programming and **NO SHAREWARE** here! Peregrine Dynamics, 720 Portage Trail, Cuyahoga Falls, OH 44221.

Quality Reconditioned TEST EQUIPMENT

Fluke 5200A

Programmable Voltage Calibrator, outputs from 100 μ V rms to 120 V rms at 50 mA current level.



Special \$1100.00

Fluke 5215A

Precision Power Amplifier, output voltages to 1100 Vrms, max output of 200 Watt, 10 Hz to 120 kHz.

Special \$1100.00

Fluke 5440A

Calibrator, 4 ppm, completely programmable, output from 0 to 1100 V dc, boost output and divider output from 0 to +2.2Vdc.

Special \$3500.00

Fluke 8012A

Digital Multimeter, 3.5 digits, seven functions, 0.1% basic accuracy, true-rms ac, from 45 Hz to 50 kHz, 10A range, 2 Ω and 20 Ω range.

\$175.00

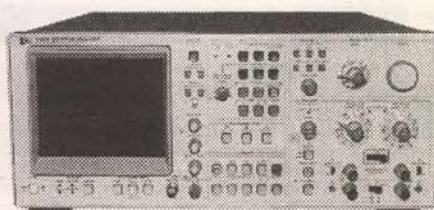
Hewlett-Packard 8657A Opt 002

Signal Generator, 100 kHz to 1040 MHz, 10 Hz resolution, output power +13 to -143.5 dBm into 50 Ω . Opt 002, RF connectors on rear panel.

Special \$3900.00

Hewlett-Packard 3582A

Spectrum Analyzer, .02 to 25.5 kHz, 0.02 Hz resolution, 70 dB dynamic range, transfer function, coherent function, phase spectrum, and frequency domain analysis, internal noise source, HP-IB.



Special \$1,995.00

EIP Microwave 548A Opt W-36

Microwave Frequency Counter, 10 Hz to 26.5 GHz, 12 digit LED display, sensitivity 25 mV rms (10 Hz to 100 MHz) -15dBm (22 to 26 GHz). Opt W-36 includes the following options and modifications: Opt. 05, oven stabilized time-base, opt. 06, extended frequency capability, opt. 08 GPIB, W-11, 50/60 to 400 Hz operation, EMI/RFI shielding.

\$3,900.00

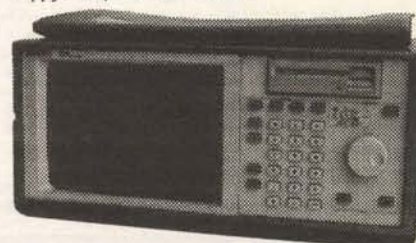
Hewlett-Packard 1650A

80 Channels of 25 MHz state or 100 MHz timing, trigger or pattern across 80 channels, built-in 3.5" floppy drive, with accessories.

\$1995.00

Hewlett-Packard 1650B

80 Channels of 35 MHz state or 100 MHz timing, trigger or pattern across 80 channels, built-in 3.5" floppy drive, with accessories.



\$2750.00

Hewlett-Packard 8901B

Modulation Analyzer, 150 kHz to 1300 MHz, measures AM and FM to 1% accuracy, measures RF frequency, measures power, low internal noise, completely automatic. Options available.

\$4,250.00

Hewlett-Packard 8903B

Audio Analyzer, 20 Hz to 100 kHz, combines the functionality of a low distortion audio source, frequency counter, high performance distortion analyzer, SINAD meter, and a ac/dc voltmeter.

Special \$3500.00

Hewlett-Packard 5350B

Microwave Frequency Counter, 500 MHz to 20 GHz, 11 digit display, 1 GHz tracking speed, measures frequency, period, period average, ratio, totalize, and time-interval. Sensitivity to -40 dBm.

\$4375.00

Hewlett-Packard 8640B

Signal Generator, 0.5 to 512 MHz, -149 to +19 dBm RF output, phase locking and counter.

\$1,250.00

Hewlett-Packard 8350A/83545A

Sweep Oscillator Mainframe with Sweep Oscillator plug-in. Plug-In capabilities; 5.9 to 12.4 GHz frequency range, 50 mW max leveled power, complete HP-IB programability.

\$3,250.00

Hewlett-Packard 5335A

Universal Counter, 200 MHz, built-in automatic rise time, cycle, pulse width, slew rate and phase measurements. Automatic triggering.

Special \$750.00

Hewlett-Packard 8494B Attenuator

Manual, dc to 18.0 GHz, 0 to 11 dB in 1 dB steps.

\$450.00

Hewlett-Packard 8495B Attenuator

Manual, dc to 18 GHz, 0 to 70 dB in 10 dB steps.

\$450.00

Tektronix SG504

Signal Generator, provides a leveled output amplitude that is variable 245 to 1050 MHz in 2 bands. Amplitude range is 0.5 V to at least 4 V p-p.

Special \$2750.00

Tektronix 465B

100 MHz Oscilloscope, 5mV/div sensitivity, 2 nS sweep rate, delayed sweep, trigger view and beam finder. Includes 2 probes.

\$675.00

Tektronix 466

100 MHz Storage Oscilloscope, dual trace, 5 mV/div, stored writing speed of 3000 div/ μ s variable persistence. Includes 2 probes.

\$575.00

Tektronix 485

350 MHz Oscilloscope, dual trace, 5 mV/div sensitivity, 1 ns/div sweep rate, 3.0 div/ns writing speed, selectable input impedance. Includes 2 probes.

\$895.00

(602) 483-6202 • Fax (602) 483-6403

14455 North 79th Street, Unit #C • Scottsdale, Arizona 85260

WANTED: USED TEST EQUIPMENT

Write in 81 on Reader Service Card.

Nuts & Volts Magazine/June 1998 **43**

DANBAR SALES COMPANY

LIQUIDATION WIN 95 companion, Wordperfect Suite, Printmaster Deluxe, 7 CDs retail value over \$1,000 sacrifice price \$53. 1,000 games, Encarta 10 CDs \$25, DOS \$25. Call 714-778-0450.

MICROSOFT OFFICE 97 PROFESSIONAL EDITION \$75. That's right, \$75. Includes Word 97, Excel 97, Access 97, PowerPoint 97, and Outlook 97. Brand new, unopened, and shrink-wrapped. Easy fulfillment-online documentation, online manual, and CD-KEY. \$3 S/H. Visa/MC accepted. Call Gulf Professional Services toll-free 1-888-208-9797, or order online at www.gulfpro.com E-Mail: sales@gulfpro.com

X10, SPIO, Abus and other software for IBM (DOS & Windows), Mac, Apple-2, Tandy, others. Basic, Pascal, C. Contact Wilmington Computer Applications. (www.local-net.cncost.com) or 978-658-9950.

COMPUTER EQUIPMENT WANTED

WANTED: FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

WANTED: TERMINALS + PRINTERS: DEC, Wyse, IBM, ADDS, Okidata, Data South, Epson, C.I.T.O.H., etc. Call for quote on any surplus computer equipment. Call Jeremy, 603-673-8077.

HP CALCULATORS wanted: models 10, 70, calculator watch, others for private collection. Cash paid. Bob Morrow, 765-855-2348, rkmorrow@aol.com

TEST EQUIPMENT

STANDARDS, CALIBRATORS: Fluke C41 shunt kit \$1,999, 332B \$750, 760 \$600, 760 \$350, 721A \$595, 80E-10 \$225, 873A, 883A, 885A, 887/887AB, 895A, 931B, new and used boards & cables for 7505B, 1100A, etc. L & N: 4035-B 1,000 ohm, unused, orig. box, papers, \$450. Rubicon 91396 10 ohm primary \$325. Gray: 30215 0.001 ohm ABS \$450. L & N 8163 platinum thermometer (huge) \$1,495. Honeywell 1407/1507 universal direct reading ratio set \$350. Recard Jahre primary coaxials D62 2MF \$125, D63 3MF \$125. HP 738A voltmeter calibrator (AC/DC) \$475. HP 745A/746A, books, \$750, 3420B \$450. Eaton/Ailtech 7009 hot/cold noise, two coax adapters, \$475. CEC force-balance transducers. MKS pressure M & C systems. Military F-258-1 universal tester, temperature control \$495. G-R 1652A limit bridge, 7-decade \$295. ESI 830-120-876 \$2,600. Eaton 3161-2K loadcell \$325. Cohu 303B-R \$320. Eppley 1963 standard cell \$125. General Mills/BUORD T-3028 electronic analyzer of calibrator (AC/DC) \$440. Atlantic Research PPC-1 pressure pulse calibrator \$220. Kintel M10A-10 meter calib. (tubes) \$150. List of other t & m. aklinger@flash.net 817-370-2575.

HP 8405A vector voltmeter, \$800, HP 3455A, \$500; HP 3456A, \$800; HP 6111A 0-20V precision power supply, \$200; HP 4815A vector Z meter, \$1,500; HP 5328A counter, \$400; HP 5326B counter, \$200; EIP source locking counter, 18GHz, \$1,000; HP 3580A, LED spec. ana., 10Hz-50KHz, \$1,000; Collins URC32/KWT-6 HF transceiver, \$1,500; Tektronix 7633 100MHz storage frame, \$350; HP 1600A logic ana., with probes, \$300; HP 3570A network ana., \$400; HP 8690B sweeper frame, \$300; HP 8698B, sweeper plug-in, 4-110MHz, \$400; HP 8601A sweeper, 4-110MHz, \$450; HP 8697A sweep plug-in 26.5-40GHz, \$500; HP 432A, 468A power meter, \$350; HP 432B, 8468A, power meter, 10MHz-18GHz, \$500. A-Comm Electronics 303-290-8012.

HEWLETT PACKARD: 3722A noise generator, \$100; 427A multimeter, manual, \$60; 400E AC voltmeter, \$45; H04-400EL AC voltmeter, \$35; 1602A logic analyzer, \$40; 3440A/3442A DVM, \$40. **General Radio:** 1394A high rate pulse generator, \$125; 1551B sound level meter, \$75; 1208B unit oscillator, \$40. **Tektronix:** 3L5 spectrum analyzer plug-in, \$125; 528A waveform monitor, 1420 vectorscope, rack mount, \$575. **Fluke:** 1722A instrument controller, \$225; 8520A 5-1/2 digit multimeter, HPIB, \$200. **Nicolet:** UA-500A spectrum analyzer, manual, \$75. Kent, 515-232-7528.

HP 334A, \$500; HP 339A, \$1,500; HP 5340A, \$1,200; HP 3325A, synthesizer, \$1,600; HP 8640B sig. gen. 5-1200MHz, \$2,000; HP 3330B, synthesizer, \$500; HP 6012A power supply 0-60V 0-50A, \$1,200; HP 3586B, \$1,000; Fluke 6160B synthesizer, \$500; Fluke 6160B opt 2, \$800; Fluke 750A reference divider, \$600; Fluke 5200A AC calibrator, \$1,200; Fluke 5215A AC amplifier, \$1,200; HP 141T, 8553B, 8552A, \$1,200; HP 141T, 8553B, 8552B, \$1,500; HP 141T, 8554B, 8552B, \$1,800; HP 141T, 8555A, 8552B, \$2,000; A-Comm Electronics 303-290-8012.

FED-LOG on CD-ROM. Have you wondered what all those numbers were on government sales catalogs? Now be able to identify all government stock numbers for price, mfg., part number, description. \$350 a set. Call TJ's Wholesale Surplus 904-897-6482. E-Mail: TOMFORSHE@AOL.COM

SEC Sun Equipment Corporation

P. O. Box 97903, Raleigh, NC 27624 E-mail: sunequipco@ipass.net
To request FREE CATALOG, please call, fax, write, or e-mail us.

Quality Test Equipment for Cost-Minded People

DC POWER SUPPLY (CC/CV)

All models: protection of short ckt, overload, reverse polarity, overvoltage; Constant Current & Voltage (CC/CV) fully adjustable. Regulation: $\leq 0.1\% + 3mV$ (line) / $\leq 0.1\% + 3mV$ (load); ripple $\leq 1mV$.

SINGLE OUTPUT

Analog Displays
PS-303 \$159.00, 30V/3A.
PS-305 \$219.95, 30V/5A.
PS-1610S \$289.00, 16V/10A.
PS-2243 \$139.00, 12V/24V select, 3A.
PS-2245 \$159.00, 12V/24V select, 5A.
8107 \$399.95, 30V/10A.
8110 \$289.95, 60V/3A.
8112 \$399.95, 60V/5A.

Digital Voltmeter & Analog Ammeter

8200 (8201) \$179.95 (\$239.95), 30V/3A (5A)
Digital Displays 8210/8300 \$199.95, 30V/3A.
8211/8301 \$259.95, 30V/5A.

DUAL OUTPUTS

Independent/Tracking
Analog Displays
8108 \$549.95, 60V/3A.
8109 \$699.95, 60V/5A.
PS-303D \$314.95, 30V/3A. PS-305D \$399.95, 30V/5A.
TRIPLE OUTPUTS, a fixed 5V/3A output, Indep./Tracking
Digital Displays 8202 (8203) \$499.95 (\$549.95), 30V/3A (5A) x2.
Analog Displays 8102 (8103) \$399.95 (\$489.95), 30V/3A (5A) x2, with Parallel (30V/6A) and Series (60V/3A) Mode operation.

NTSC/PAL TV COLOR BAR GEN.

CPG-1366A \$159.95, VHF NTSC;
Freq.: 45.75, 175.25, 187.25 MHz;
RF Output: 10mV; Impedance: 75 Ω ;
Video Output: BNC, 1V_{p-p};
Power: 9VDC; 9V AC adapter (\$6).
CPG-1367A \$159.95, VHF PAL.

SWR/RF/mW POWER METER

310 \$89.95, 1.8-150MHz, RF Power: 0-4W/20W/200W 3 ranges; SWR Measurement: 1.0- ∞ , 4W min. Accuracy: 5-10%; Insert Loss: 3dB In/Output Imp.: 50 Ω ; SO-239 plug.
320 \$89.95, 130-520MHz. Spec. 310.

SWR-3P \$26.95 1.7-150MHz, RF Power: 0.5-10W, 0.5W-100W.
SWR-2P \$22.95, 1.7-30MHz, RF Power: 0.5-10W.

mW RF Power Meter 340 \$219.00, 1.8-500MHz, RF Power: 20mW/200mW/2W 3 ranges; Imped.: 50 Ω ; Accuracy: $\pm 10\%$ full scale; SWR ≤ 1.15 ; N-type connector, BNC type output

FM STEREO MODULATOR

AG-2011A \$549.00
RF SECTION:
Carrier: 98MHz ± 2 Hz;
Output: 10mV, 1mV & 0.1mV
COMPOSITE SIGNALS:
Pilot: 19KHz ± 2 Hz, 0.8Vrms
INT. MODULATION: 400KHz, 1KHz $\pm 1\%$, 1Vrms, distortion $< 5\%$; L-R Separation: > 50 dB.
EXT. MODULATION: Freq.: 50Hz-15KHz
L-R Separation: > 45 dB 100Hz-3KHz; > 35 dB 50Hz-15KHz

TOOLKITS - ELECTRONIC/PC

9745 \$29.99 U.S. Patented, 45-pos. Contents: IC insert/extractor with secures & bows, 3-prong part retriever, #0 phillips screwdriver, 1/8" flat screwdriver, self-hold tweezers, metal tweezers, part tube, soldering iron, solder, crimping tool, long-nose plier, cutting plier, zipper vinyl case. Bits include: Phillips: #0/#1/#2/#3; Flat: 1/8"/3/16"/1/4"/5/32"; PZ1/PZ2; T8/T9/T10/T15/T20/T25/T27/T30/T40/T45; Hex: 5/64"/3/32"/1/8"/5/32"/3/16"; Sockets: 3/16" (5mm)/7/32" (5.5mm)/1/4" (6mm)/9/32" (7mm)/5/16" (8mm).
8G23 \$34.99 23-pos. Contents: IC insert/extractor with secures & bows, 3-prong part retriever, 3/16"/1/4" nutdriver, 3/16"/1/8" slotted screwdriver, #0/#1 phillips, reversible T10/T15 bits, reversible #2 phillips/1/4" slotted bits, tweezers, long-nose plier, cutter, 6" adj. wrench, soldering iron, solder, crimping tool, zipper case. Various packages available, call/write/e-mail/fax for detail.

STEREO/ALIGN/SWEEMAR SCOPE

STEREO SCOPE OS-7505B \$369.00, 0-10MHz/20mV.
ALIGNMENT SCOPE OS-7001A \$369.00, 0-200KHz/1mV.
SWEEMAR SM-6225B/CS1999.95
Freq Range: (AM)400KHz, (FM)10-11.4MHz, Accuracy: $\pm 0.1\%$;
Marker: (AM)455KHz, ± 5 KHz, ± 10 KHz, (FM)10.7MHz ± 7.5 KHz ± 15 KHz

LODESTAR Lodestar Electronics Corp. Since 1979

One Year Warranty. 15 Day Money Back Guarantee. OEM WELCOME.

School purchase order accepted. Bids accepted. **VISA, Mastercard**

SALES REP/DISTRIBUTORS/OEM WANTED. Discover, AmrExpr

1-800-870-1955/(919)870-1955 Fax:(919)870-5720

RF SIGNAL GENERATOR

SG-4160B \$124.95, 100K-150MHz up to 450MHz on 3rd harmonics in 6 ranges; AM modulation; Accy: $\pm 5\%$ RF Output: 100mVrms to 35 MHz; Modulation: Int. 1KHz (AM); Ext. 50Hz-20KHz, at least 1V_{rms} input. Audio Output: 1KHz, 2V_{rms} min.

SG-4162AD (w/ Freq. Counter) \$229.95, Spec. see SG-4160B.
COUNTER SECTION: 10Hz-150MHz; Max. Input: < 3 Veff; Gate Time: .1, 1sec. Input Sensitivity: 35mV, 10Hz-200MHz. Input Impedance: 1M Ω (HF), 50 Ω (VHF). Display: 7-digit LEDs.

AM/FM STD SIGNAL GEN.

SG-4110A \$179.00, Freq: 0.1-110MHz; Display: 6-digit LED; Resolution: 100Hz (0.1-34.999MHz); 1KHz (35MHz-110MHz). Accuracy: $\leq 5 \times 10^{-3} \pm 1$ count; Output: -19dBu-99dBu, 1dB steps. Imped.: 50 Ω VSWR 1.2; 100 preset frequency, store funct.

AUDIO GENERATOR

AG-2601A \$124.95, 10Hz-1MHz in 5 ranges; Output: sine wave 0-8V_{rms}; square 10V_{p-p}. Output Imped: 600 Ω Distortion: $< 0.05\%$ 500Hz-50KHz; $< 0.5\%$ 50KHz-500KHz.
AG-2603AD \$229.95, with 6-digit, Int/Ext. Freq Cntr, 10Hz-150MHz, Output Control: 0/-20/-40dB & fine adjuster, spec. see AG-2601.

FUNCTION GENERATOR

FG-2100A \$169.95, 0.2Hz-2MHz in 7 ranges; sine, square, triangle, pulse & Ramp; Output: 5mV_{p-p}-20V_{p-p}, 1% distortion. VCF: 0-10V/Freq. to 1K:1
FG-2102AD \$229.95 see FG-2100A; 4-digit counter display; CMOS & TTL Output, 30ppm ± 1 cnt accuracy

FG-2020B \$159.00 0.5Hz-500KHz, Sine, Square, Triangle.
FG-2103 \$329.95, Digital sweep generator, 0.5Hz-5MHz in 7 ranges. Operating Mode: sweep, AM, gated burst, VCG. Freq. Counter: Int. 0.5Hz-5MHz; Ext. 5Hz-10MHz.
FG-513 \$769.95, 13 MHz, Microprocessor embedded sweep; Freq. Counter & TCXO: 5Hz-100MHz, 6.5 digits, x1/x20 attenuation; Sine/Square/Triangle/Pulse/Ramp/TTL & DC; $\pm 0.1\%$ (1).

AC MILLIVOLT METER

MV-3100A \$159.95 wide band 5Hz-1MHz, 3 scales, mV/dB/dBm; 300 μ V-100V in 12 ranges, 10 μ V resolution; -70-40dB in 12 ranges, 0dB=1Vrms, 0dBm=0.775V; $\pm 3\%$ accuracy; Input impedance 10M Ω ; Noise $< 2\%$.
MV-3201B \$309.95 2 ch.; simultaneous measurement; spec see MV-3100

OSCILLOSCOPES

OS-7305B \$249.00 DC-7MHz, 3" CRT; Horiz: 25V/div; 10Hz-100KHz in 4 ranges; Vert: 10mV/div; Int/Ext. sync.; Input: 1M Ω /35pF.
OS-7010A \$299.95 10MHz, 5" crt; Horiz: 2V/div; Vert: 10mV-10V/div
OS-622G \$389.95 20MHz, 2 CH.; Alt trig, trig. lock, hold off, TVsyn.

8x10 div., 1mV/div.; Horiz: 2 μ s-5 μ s/div; Vert: 1mV-5V/div.
OS-653G \$699.95 50MHz, 2 CH/delay sweep, Alt trig., TV syn.
OS-6101G \$1499.95 100MHz, 4ch/8 traces, delay sweep, cursor readout. 2 years warranty for OS-620, 622G, 653G, 6101 & 6102

UHF ATTENUATORS

RT-8815U (50 Ω) \$299.00 / RT-8817U (75 Ω) \$299.00, 950MHz, 81dB, 0.5W max.; Steps: 1/2/3/5/10/20/20/20, 8 switches.
085E-2 (50 Ω) \$399.00 / 087E-2 (75 Ω) \$399.00, 950MHz, 81dB, 0.5W max.; Steps: 10dB+7.1dBx10. Electronic adjustment knob.

MICROPROCESSOR TRAINER

BGC-8088 \$699.00, learn computer theory. Excellent for school & individual who want to learn about ROM, RAM, I/O ports, programming, & run a 8088 Microprocessor. An easy to understand step-by-step manual guides you to achieve your goal. 56-key keyboard, LCD display, RS-232, UART...

GRID DIP METER

DM-4061 \$89.95 1.5-250MHz, 6 bands; 6 plug-in coils, 2 transistor, and 1 diode. Modulation: \approx 2KHz Sinewave. Crystal Oscillator: 1-15MHz. Wave absorption meter. 9VDC battery.

FREQUENCY COUNTER

FC-5250C \$119.95 10Hz-220MHz HF: 10Hz-20MHz; VHF: 10-200MHz Gate Time: .1, 1s; Max. Input: 10V_{p-p} Sensitivity: 35mV/10Hz-200MHz; Input Imped.: HF: 1M Ω ; VHF: 50 Ω ; Display: 7-digit; 9V adapter (\$6).
FC-5260A \$129.95 10Hz-600MHz, 7-digit LEDs. 9V AC adapter (\$6).
FC-5270 \$149.95 10Hz-1.2GHz, 8-digit LEDs. 9V AC adapter (\$6).
FC-5600B \$229.95 10Hz-600MHz, 10-digit LEDs; 110/220VAC.
FC-5700 \$299.95 10Hz-1.3GHz, 10-digit LEDs; Period measure

SIGNAL TRACER/INJECTOR

SE-6100 \$149.95 \$89.95 (Reduced!)
TRACER: Gain 60dB maximum. Attenuation: 0/20/40/60dB
Input Imped: 100k Ω ; Meter: Vu, 1mA
Output Imped: 600 Ω ; Speaker: 8 Ω .
INJECTOR: \approx 1KHz Squarewave; Output Level: Variable 0-4.5V_{p-p}; 9V battery or adaptor (\$6.00).

LCR METERS

MIC-4070D \$179.95, L: 0.1 μ -200H, C: 0.1p-20mF, R: 1m Ω -20M Ω , 2Q range, Dissipation factor measurement, Zero adjust; Surface mount device (SMD) test probe: LT-06 \$21.95

DIGITAL MULTIMETER

DMM-120 \$24.95, 3 1/2 dig.; 600VDC, 2ADC 500VAC, 2M Ω , hFE/diode/continuity; 1.2%
DMM-123+Cap. \$44.95, 3 1/2 digit; 600VDC, 600VAC, 10ADC/AC, 2G Ω , 20 μ F, hFE & diode test, continuity beeper, 0.8% accuracy.
DMM-124+Cap.+Temp.+Freq. \$69.95, 3 1/2, 600VDC/500VAC, \approx 58-752 $^{\circ}$ F, 2G Ω , 20mF, 200KHz, 3-phase/diode/continuity test; 1.2%
DMM-125 \$54.95, Auto/Bargraph, 32M Ω , 600VDC/AC, 10ADC/AC, diode/continuity.
MIC-35 \$59.95, 3 1/2 LCD, Autorange 20M Ω 1000VDC/750VAC, 20ADC/AC, data hold, diode/continuity test, free holster, 0.5% acy.
MIC-39 \$129.95, Auto/Bargraph, True RMS, 3 1/2 LCD, 40M Ω , 40 μ F, 1000VDC/750VAC, 20ADC/AC, 600KHz freq. cntr, data hold, sleep mode, memory, read functions, holster; 0.3% accuracy.

AUTO. CAPACITANCE METER

CM3300A \$139.00 10 ranges, 99.9pF \approx 99.9mF, fully automatic. Resolution: 0.1pF lowest, 0.1% full scale. Accuracy: 0.5% of full scale ± 1 digit to 99.9 μ F, 1% of full scale ± 1 digit to 99.9 μ F. Display: 3 digit LED.
Unit: pF, nF, μ F, mF, Overflow indicator.

AUTO DISTORTION METER

DM-3104A \$799.95
DISTORTION MEASURE
Range: 0.01% to 30%, 0.1/0.3/1/3/10/30% 6 ranges. Freq: 400Hz $\pm 10\%$, 1kHz $\pm 10\%$ (HPF). Input: 3mV-100V; Ratio meas. 20dB. Auto. Freq. Switching Ranges: Fundamental Freq. = (fo) $\pm 10\%$; Fund. Rejection: > 80 dB at (fo) $\pm 5\%$; > 70 dB at (fo) $\pm 10\%$. Harmonic Accuracy: ± 0.5 dB, 1.8(fo)-20KHz. LEVEL MEASURE Range: 0-100V; 0.3/1/3/10/30/100V; Freq Response: ± 0.5 dB/20-50KHz; ± 1 dB/20-100KHz. DM-3204 \$1,599.00 dual channels; Spec see DM-3104A.

WOW-FLUTTER METER

WF-3103A \$699.95 Freq. Range: 3KHz $\pm 10\%$ JIS/CCIR; 3.15KHz $\pm 10\%$ DIN. Measure: 0.3/1/3/10/30% full scale. Accuracy: $\pm 5\%$ of full scale. WF-3105A \$799.95 digital display Function: LIN/WOW/Flutter/WT.D. Freq Counter: 10Hz-9.99MHz. Indication: CCIR/DIN/JIS.

HP 5501A LASER align system, 9831A, 9865A, 5510A, cables, etc., \$595. Spectra-Physics 128 HeNe LASER + 250 exciter \$1,600. Huge 8-foot S-P flowing mixable gas LASER "cannon" \$550. Like new Tektronix 7612D programmable digitizer, plugs, books, \$550. 3M/Dynatel URSPNDER 56A micro-responders (telephone auto-responders), 3 new \$150 ea. WICAT systems SR-1225 classroom computer/server (Apple/Mac), multiplexers, misc., \$350. Much more. aklinger@flash.net 817-370-2575.

RF GEAR: Collins 32MS-1B (5223548-000) 4-channel remote-tuned (KWM2-type?) transceivers (2) \$325 ea. Empire NF157 power meter 0.1-10GHz, antennas, case \$825. FEL 136A PhaseLock synchronizer 1-18 & 18-40GHz \$575. Fairchild Electro-Metrics EMC-10 with LAC-10 kit \$1,600. FLUKE 645M synthesizer \$375. Stoddard L-101A (2) \$75 each. Cubic DM-20 distance radar transceivers (pair) \$850. HP 905A \$195, 907A \$175, P486As \$65, M486A \$80, X486A \$50, J532A \$135, P532A \$145, 537A \$145, X910As, X914A, G424A, H424A, etc. Microline 3072, 3074, 3075/5075 etc. More. aklinger@flash.net 817-370-2575.

SYNCHRO-RESOLVER GEAR: ASI A1202S/R-0.1 Synchro-resolver standard, \$795. DDC SR102A \$395, SR103 \$450. Gertsch DSRB/5C/4R \$800, DSRB-7R \$850, NI/5R \$450, PAV-2AR \$500, PT-5 \$350, PT-7R \$375, PT-11R \$375, RT-11R \$260, RT-20R/R1S3 \$475, RT-1953R \$575, SS-4R \$375, SS-5AR \$350, SS-5AR \$325, SS-7R \$575, 218 \$275, 1001 \$750. Military MTL-41673 360 degree proportional bridge \$175. Tester with 3 fused Gertsch coaxial ratio transformers plus timer \$575. List of other t & m. aklinger@flash.net 817-370-2575.

SCOPE SALE: Tek 7000 frame w/7A24, 7A26, 7B85, 7B92A, \$600, 2 available; Philips PM3217, \$200; Kikisui 50MHz 4 channel 5042, \$200; Tek 475 w/DM44, \$400; 466, \$400; 7A13, \$100 LED; 7A18, \$45; 7A19, \$100; 7A26, \$60; 7B53A, \$60; 7B80/7B85, \$75 ea.; 7B92A, \$125; 7D15, \$175; 7D20, \$250; AA-501A distortion analyzer, \$650; DC504, \$175; DC5009, \$200; PG-508, \$350. CALL FOR OTHERS. All with 30-day warranty. Call **Psitech Plus**, phone 707-745-4804, fax 707-747-5277. E-Mail: apeas@ix.net com.com

EQUIPMENT SALE: Anritsu 645A, both the sending & receiving unit for \$300; Siecor M42 optical time domain reflectometer, \$400; HEWLETT PACKARD 8007B pulse generator, \$200; Leader LPS-152 DC tracking supply, \$200; Fluke 8000 DMM, \$60; NJE 0-20V, 0-1A bench supply, \$50, 6 available; **ALL new factory boxed** Tektronix PS 283 75 watt triple supply, \$325; 2510 36V 3.5A bench supply, \$350. **Psitech Plus**, 707-745-4804, fax 707-747-5277. E-Mail: apeas@ix.net com.com

WE BUY electrical power systems test equipment. This includes the following manufacturers: **Multi-Amp** (now AVO Multi-Amp), **Biddle** or James G. Biddle (now AVO Biddle), **Megger** (now AVO Megger), **Associated Research**, **AEMC**, **EIL**, **Programma** or any other test equipment used for testing high voltage equipment and components. The test equipment that we are looking for is used for testing high voltage transformers, circuit breakers, cables, and protective relays. FAX 972-564-9139 or phone 1-800-261-9139 for quote. **Phase-3 Power Test Equipment.**

O'SCOPE SALE: Tek 485 350MHz \$595; Tek 475A 250MHz \$525; Tek 475 200MHz \$475; Tek 465B 100 MHz \$425; Tek 468/DM44 100 storage \$795; Tek 464 100MHz storage \$295; Tek 465 100MHz \$350; Tek 455 50MHz \$175; Tek 2213 60MHz \$375; Tek 2213A 60MHz \$425; Tek 2215 60MHz \$450; Tek 2215A 60MHz. All equipment in good working condition. Charlie @ Trident Engineering 805-642-4329, fax 805-642-2259.

FEITEK PROVIDES repair, calibration and certification on many makes of test equipment. We also have a large selection of used equipment. Send large SASE envelope for list. VISA and MasterCard accepted. Feitek Inc., 2752 Walton Road, St. Louis, MO 63114, 314-423-1770.

NEW HEWLETT-PACKARD 141T CRTs. \$195 EACH. We have quantities available. These are double boxed, unopened with late 80s date code, guaranteed. Fits all 141T spectrum analyzers. Contact Brian at Kentronix. 732-681-3229 or FAX 732-681-3312. Mailing: Kentronix, PO Box 2444, Farmingdale, NJ 07727 or E-Mail brian@kentronix.com

NEW HEWLETT-PACKARD 141T CRTs. \$195 EACH. We have quantities available. These are double boxed, unopened with 1985 date code, guaranteed. Price is \$195 each plus shipping. Contact Brian at Kentronix. 732-681-3229 or FAX 732-681-3312. Mailing: PO Box 2444, Farmingdale, NJ 07727 or E-Mail brian@kentronix.com

GR 916AL RF bridge, \$350; ESI 250DE RCL bridge, \$250; HP 4260A RCL bridge, \$250; Boonton 93A true RMS meter, \$150; HP 3400A, \$300; Boonton 42B micro wattmeter, \$350; Boonton 42BD dig. power meter, \$450; Leeds and Northrup 4393 universal ratio set, \$500; Keithley 614 electrometer, \$800; A-Comm Electronics 303-290-8012.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

KENTRONIX TEST EQUIPMENT SPECIALS. Check our WEB site at <http://www.kentronix.com> for monthly specials. We are also looking to buy test equipment, coaxial and waveguide components, manuals, etc. Contact Brian at 732-681-3229 or FAX 732-681-3312. E-Mail: brian@kentronix.com



RAINBOW KITS

Many of our kits are available completely built!

PIC RELAY CONTROLLER

This is a good companion for any kit that need additional amperage or a micro-controlled relay function.

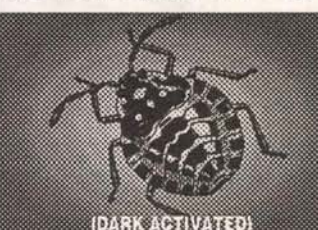
Relay functions listed below are preset.

- ON / OFF toggle mode
- ON / RESET mode
- Fixed delay .5 second pulse stretch
- Fixed delay 10 second pulse stretch
- Variable time 1.5 to 14 sec.
- Variable time 11 to 24 sec.
- 3 Amp. total output
- Input and reset signal can be Active HI or LO
- Wall transformer included

Voltage requirements 7.5 to 15vDC Size: 1.75" x 2.7"
PRC-1 KIT \$24.95
PRC-C Case \$12.95



CALLER ID DEFEATER
The kit that brings back the privacy in phone calling. I know you can defeat CALLER ID if you dial *67, but how often do you remember to do that? This kit dials *67 automatically. Now nobody can identify you as the caller. Easily modified for Centrex telephone systems. We supply a DC wall transformer. PCB size: 2.75" x 2.25" Case Included
CID-1 BUILT \$69.95 KIT \$49.95



A Cricket, gets in your house and runs you crazy till you find it

Well this is no different, sneak this little NIGHT CRICKET into someone's bedroom, or cozy little nook, when night falls the fun begins. It's like a bad dream the lights go out and the cricket start chirping, turn the lights on to find the varmint and the chirping stops. It drives you nuts! Operates on a 9v battery. Small enough to hide most anywhere 2" x 3". You may want to get more than one. How many friends do you want to loose?

NC-1 KIT \$14.95



This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

10 in 1 ULTIMATE LASER POINTER



The next generation of laser pointers is here! Project 10 different patterns from this unique new design without changing the lenses. This laser is so small it can be concealed in the palm of your hand. Keep people guessing where it is coming from! Dot has over 1,600 ft. range. Comes with Deluxe Key Chain. Powered by 3 LR44 batteries (included) Size: 1 7/8" dia x 5/16"
LAS-UFO BUILT \$29.95

LASER CHALLENGE

Great game for the Laser Pointer
Set your target across the room or pin it to your chest. You can set it anywhere up to 25 yards. Use the laser pointer to shoot the target and the alarm goes off. Fun for kids and adults, great for laser tag fun. Power requirement: 9v battery PCB size: 1.5" x 1.2"
LAS-1 TARGET INCLUDED KIT \$14.95

FAN CONTROLLER

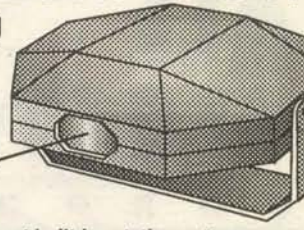
Use this kit to control cooling fans. It senses heat and turns on a fan. The fan can be a ceiling fan or a fan in your computer, anything that needs cooled. Output is 100mA. Use the Relay kit RP-1 or the new Micro-controlled Relay PRC-1 kit for 3 amp. operation. Complete with temperature probe. Operating voltage: 7.5 to 18v DC Size: 1.5" x 1.2"
FC-1 KIT \$14.95



SUPER SNOOPER BIG EAR
Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away. The BIG EAR can be hidden about anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to 12v DC. SIZE: 1.75" x 1"
AA-1 BUILT \$29.95 KIT \$10.95

LASER LIGHT SHOW

Club Effect Lighting
Portable
Red Laser

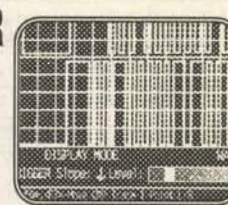
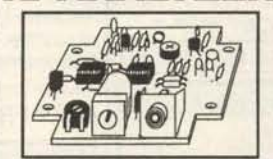


12 preset built-in rotating patterns
Auto mode: Adjustable Music mode: Controlled by microphone On/Off switch and auto/music switch Includes 4 "AAA" batteries
3mW laser diode
LASHW-1 BUILT \$69.95

THE MIGHTY WIZARD

You can throw your old Ouija board away and come into the computer age. Use your inner feelings to control THE MIGHTY WIZARD. Touch your fingers to the pads and the 4 jumbo leds flash randomly till you release your fingers. One of the leds will stay lit. We supply 6 overlays, each a different game. Let your Bio-rhythm control your destiny. Fun to build and play for the whole family. Power requirements 9v battery PCB size: 2" x 3" Game size: 5.5" x 7.75"
MW-1 KIT \$18.95

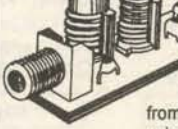
RF ANALYZER



Want to know the code of your car alarm transmitter, your garage door opener or any other digitally transmitted RF signal? This kit will extract the code from the air through the antenna input, send the signal to the computer and display it on the screen. This is all done through the parallel port. Information can be stored to the hard drive for future reference. The RF Analyzer comes complete with Dos software. You can operate this kit from a 9v battery or from a wall transformer. We supply a wall transformer with your kit. Operating voltage 7.5 to 15v DC PCB size: 2.25" x 2.75"
RFA-1 KIT \$99.95
RFA-C Case \$12.95

TV NOTCH FILTERS

FOR CHANNELS 2 thru 22 ONLY



Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels (2 thru 22) only.

NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.

DF-222 KIT \$14.95



Please add sufficient postage First lb \$5.50 Canada \$7.50 Additional LB. Add \$1.00 US FUNDS ONLY We will accept telephone orders for Visa or Mastercard

Electronic Rainbow Ind., Inc.
6227 Coffman Rd. Indianapolis, IN 46268

CALL 317-291-7262 FAX 317-291-7269
INTERNET: www.rainbowkits.com



EQUIPMENT MANUALS we have 1000's of service and operators manuals for all types of test and measurement equipment from 1950 to present. All test equipment manufacturers are represented. Call, write, or fax your want list. Please include mfg.'s manual P/N unit serial numbers if known. **Manuals Plus**, Box 549, TAD #601, Tooele, UT 84074. 435-882-7188, FAX 435-882-7195.

AM-FM SERVICE MONITORS bought & sold. IFR, Motorola, Wavetek, Marconi, Triplet, HP. **FOR QUOTE CALL TEST-TRONICS.** Full calibration & repair, reasonable rates. A division of Communications Signalling Inc. 1-888-423-2565, 805-251-2244, Fax 805-252-3100.

EFRA TOM FRS-C miniature late 10MHz rubidium atomic frequency standards, \$500, 2"x3"x4". 212-243-7964 or <http://www.vigilante-electronics.com>

WANTED: LATE model TEST EQUIPMENT and test equipment MANUALS, HP, Tektronix, and others. Fax your for sale list to 410-750-1192 or mail to US Surplus, PO Box 37, Ellicott City, MD 21041, Attn: Ron Baublitz. Phone # 410-750-1083, E-Mail: ussurplu@clark.net

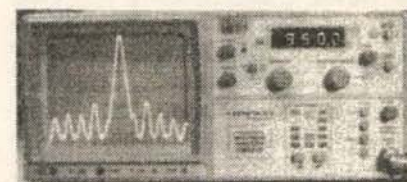
WANTED: WESTERN electric test equipment. Tube-type only please. Freq. measurement sets, oscillators, amplifiers, coils, transformers, parts, tubes. **Free offer, Great Wireless Museum** 1-800-653-6427.

WANTED: ELECTRONIC estates. Ham, broadcasting, military, test, public address, tubes, transformers, telex equipment. The bigger the pile, the more worthwhile. We fly anywhere. Sumner McDanel 1-800-251-5454.

BRUEL & KJAER BUY, SELL, BEST PRICES. EXCALIBUR ENGINEERING, 3198-C AIRPORT LOOP DRIVE, COSTA MESA, CA 92626. 714-540-0169, FAX 714-540-5417.

FOR SALE: Eighty (80) 1V to 12VDC lab power supplies w/meters \$1,200. Tek R7704 200MHz w/readout, Tek 7B80, 7B85, 2 ea. 7A24 \$995. Hugh M. Adams, 1011D Hondo Ave., Ft. Walton Beach, FL 32547. 904-864-2414.

TEST EQUIPMENT: HP 8901A/001/010 modulation analyzer, \$1,950; HP 8903B/001/010 audio analyzer, \$2,750; Tek 2215A scope, \$375; Tek RTD710 digitizer, \$1,750. Tek PG501 pulse generator, \$150; HP 435A power meter, \$150; HP 4261A LCR meter, \$500; EMI TCR40T125 PS, \$800; HP 3488A switch/control unit, \$700; HP 3400A RMS voltmeter, \$250. 5 day ROR, call for list. **KDM Electronics.** JASKDM@AOL.COM TEL 219-420-0063, FAX 219-426-0607.



ENGINEER TESTED: SPECTRUM ANALYZERS. Frequency counters, frequency standards, meters, scopes, generators, and more. **VISA, MASTERCARD, AMEX.** More information: [HTTP://TECH-SERVICES.COM](http://TECH-SERVICES.COM) "Performance-tested." Calibrated. Warranted. New & used. Gary, N6ZD.

ATLAS MISSILE E/F/H telemetry package flight certified. 2243.5MHz 10.6 watts PAM/FM/FM. 2 commutators, 20 VCOs. All tech data. 805-934-2058.

FEITEK HAS the test equipment you want at reasonable prices. We buy, sell, and trade HP, Tek, GR, etc. Call or fax Monday thru Friday, 9 to 5, 314-423-1770, or write us at Box 3423, St. Louis, MO 63143.

POOR MAN'S Spectrum Analyzer/Monitor Receiver Kit. 2 to 1,700 MHz. Basic kit only \$78. Now available with switched resolution filters, tracking generator and direct digital frequency readout. Works with ANY scope or IBM compatible computer. Send stamped envelope for details. Science Workshop, Box 310B, Bethpage, NY 11714. <http://www.science-workshop.com>

LOWEST PRICES! Check out Metric's "Current Specials" at <http://www.metric-sales.com> Great deals on top quality refurbished test equipment. Call 1-800-432-3424 for a free catalog.

SUCH A DEAL! Check out Metric's "Current Specials" at <http://www.metric-sales.com> Great deals on top quality reconditioned test equipment. Call 1-800-432-3424 for a free catalog.

WANTED! ELECTRONIC test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

WANTED! ELECTRONIC test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

TEST EQUIPMENT for sale/wanted: RF, Microwave, video and fiber optic. Cable TV, Broadcast TV, satellite and related industries. Wavetek, Tektronix, Hewlett Packard and other manufacturers. Spectrum analyzers, signal level meters, sweep systems, TDRs, OTDRs, and much more. PTL Test Equipment, Inc. Phone 561-747-3647 FAX 561-575-4635.

SPECIAL TEK 465M 100MHz good working condition, sale priced at \$195. All equipment in good working condition. Charlie @ Trident Engineering 805-642-4329, fax 805-642-2259.

SPECTRUM ANALYZERS: HP 8565A 22GHz, \$3,200; HP 3582A 25KHz, \$1,800; Tek 496, call for best price, Tektronix 1.8GHz 7L13, \$1,300; Tek 7L5 digital storage, phase lock, \$1,100. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

ALL ELECTRONICS

C O R P O R A T I O N

QUALITY PARTS

FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX or E-MAIL For A Free 96 Page CATALOG. Outside the U.S.A. send \$3.00 postage.

Great Sounding! KOSS DIGITAL Stereo Headphones

Koss MAC-5 Made for the Ford Motor Company for use in Windstar and Aerostar Vans. These light-weight, adjustable headsets have

great sound quality with great bass response for home or studio use. Supra-Aural foam ear cushions for hear-through sound and comfort. The 8' rubberized cords are terminated with 3.5 mm stereo phone plugs. Frequency response: 20-20,000 HZ.

\$12.50 each CAT #HP-5 10 for \$100.00

SPECIAL LOW PRICING Automotive Multi-Voltage Adaptor

Sanbor M-24 Regulated DC converter plugs into car cigarette lighter and provides power for portable audio and communications devices and many battery operated devices that operate on 500 ma or less. Voltage selector switch for 1.5, 3, 4.5, 6, 7.5 and 9 volts. Polarity switch. Six varieties of output plug including, 2.1, 2.5 and 1.3 mm co-ax power plugs, 2.5 and 3.5 mm phone plugs and 9 volt battery snap.

\$2.00 each CAT #APC-522 10 for \$15.00

High Grade Stereo VIDEO/AUDIO DUBBING CABLE

75 ohm video cable with two audio cables for stereo dubbing. Heavy-duty gold plated metal RCA plugs with spring-steel strain reliefs. Black cord 5 foot long

CAT # AVS-60 **\$5.00 each**

Dual-Tone TELEPHONE EXTENSION RINGER

AT&T # 24060 Plugs into any standard modular phone outlet so you can hear the phone from wherever you are. Allows you to select "real" bell, high or low electronic tone or turn it off all together. 6" X 3.55" X 1.62" beige case. Includes modular cord and double-sided tape for attachment to wall or cabinet.

CAT# FR-24060 **\$8.50 each**

410 uf, 300 Volt Photoflash Capacitor

Rubycon # 1A2304A 0.7" diameter X 1.7" long. Right angle PC or solder leads on 0.25" centers.

CAT # PPC-410 **\$2.00 each**

10 for \$18.50 • 200 for \$320.00

Filtered Modular Jack

Corcom # RJ11B-4L-B "Signal Sentry™" 4 pin, RJ-11 modular jack with built-in ferrite block for inductive filtering. Fits the same space as non-shielded jacks. 0.52" x 0.8" x 0.59" high. UL, CSA. Large quantity available.

CAT # MT-4F **\$1.25 each**

10 for \$10.00 • 100 for \$85.00

ORDER TOLL FREE

1-800-826-5432

MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524
INTERNET <http://www.allcorp.com/>
E-MAIL allcorp@allcorp.com

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D. • Shipping and Handling \$5.00 for the 48 Continental United States • ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.

WANTED! ELECTRONIC test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

TEKTRONIX 492-2 50KHz-21GHz SPECTRUM ANALYZERS with digital storage \$3,975. 492-123 with preselection, digital storage, frequency stabilization \$5,950. EIP 931 .01-20GHz microwave sweeper with high power option \$5,650. WJ-1250A .01-18GHz SYNTHESIZER, programmable digital sweep \$4,950. 90-day warranty. 760-439-1345 1-800-TO-BUY-TE.

10MHz RUBIDIUM FREQUENCY STANDARDS: Newer Efratom M-100 with heatsink & connector \$650 or 10/4,950. 90-day warranty. Visa/MasterCard/AMEX accepted. 760-439-1345 or 1-800-TO-BUY-TE. Webpage <http://www.angelfire.com/biz/telint/index.html>



TEK 577/D2/177 curve tracer \$850 in good condition. **CUSHMAN CE-24A** selective level meter 1KHz-3.2MHz, -80 to 20dBm, .003uV sensitivity with 50 ohm input \$150. **TEK PS 283** tripple output power supply, new in a box \$375. 10 day money back guarantee. For more great deals on test equipment please call 650-244-9438 or visit our web site: <http://www.odulo.com/corp/equiptek>

WANTED: RADIO service monitors, IFR, Motorola, HP, Marconi, also late model HP equipment. 716-763-9104 or Fax 716-763-0371. <http://www.amtronix.com>

POCKET TESTBENCH, tiny, portable, inexpensive RS-232 instrument. Oscilloscope, logic, spectrum, counter, generator modes. **Oricom Technologies**, 303-444-9776 (www.sni.net/~oricom).

LARGE ASSORTMENT of used test equipment for sale. Request list or visit my website. Credit cards accepted. Jim Stevenson, phone: 609-888-2846, Fax: 609-888-2847. E-Mail: JLStevensn@aol.com Website: <http://www.steven-sonlabs.com>

SIGNAL GENERATORS HP 8640B opt. 1,2,3 to 1,024MHz \$1,495; HP 8640B opt. 1,3 to 512MHz \$850; HP 8640B/323 512 MHz \$295; HP 8616A 18 to 45MHz \$225; HP 8614A 800 to 1400MHz \$225. All equipment in good working condition. Charlie @ Trident Engineering 805-642-4329, fax 805-642-2259.

NETWORK ANALYZER HP 8505A, 8503A, 8501A complete RF network analyzer systems, calibrated, excellent condition, \$3,250; **SPECTRUM ANALYZER** HP 8569B .01 to 22GHz \$6,600; HP 3582A \$1,595; HP 141T with 8552B, 8553B, 8554B and 8555A \$2,250. All equipment in good working condition. Charlie @ Trident Engineering 805-642-4329, fax 805-642-2259.

WE WANT to buy your excess test equipment. We will pick up and pay at time of pick up. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

METROWEST TECHNOLOGIES: Want to buy a piece of equipment but not sure of its capabilities? We will fax copy of catalog page(s) to you for review. Phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

TEKTRONIX EQUIPMENT: Curve tracers, logic analyzers, scopes, spectrum analyzers, etc. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

METROWEST TECHNOLOGIES: Boston's Equipment Supersource. Call us for a quote on your next equipment purchase. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

TEK SG504 1GHz leveled sinewave generator, call for best price. HP 3314A function generator \$2,800. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

BUYING: TEST EQUIPMENT, MEASUREMENT, CALCULATORS, CAMERAS, SCOPES, MEDICAL-LAB EQUIPMENT, ALL TOOLS. MAINE 207-493-3300.

TEKTRONIX DA4084 excellent w/manual, \$850; HP 339A excellent w/manual, \$1,200. Photos and more. T&M at www.test-equipment.net 732-445-4915.

TEKTRONIX TRACKING generator: TR503 1.8GHz for 492, 494, 496 spectrum analyzers, \$750. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

TEKTRONIX SCOPES: 2445 150MHz, 4 channel, cursors, \$1,500; 2465 300MHz, 4 channel, cursors, \$2,000. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

TEK 454A scope, \$295; PG501 pulse gen., \$70; 184 time mark gen., \$65; HP 1200B low level scope, \$75; 141T mainframe, \$250; 8556A audio spectrum analyzer plug-in, \$200; 8443B tracking generator, \$150; 313A tracking gen., \$60; 3403A RMS meter, \$95; 3406A RF voltmeter, \$95; 8170A word generator, \$60; GR 1650A RLC bridge, \$75; 546C microvolter, \$35; Fluke 8062 RMS DMM, \$130. 714-495-8649 evenings.

TEKTRONIX PLUG-INS: We have them for 7000 series scopes, TM500 mainframes, TM5000 mainframes. Metrowest Technologies, phone 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

Roger's Systems Specialist

800-366-0579



www.rogerssystems.com

MONITOR CABLES

6' HD15 TO 5 BNC
MALE TO MALE
CC-VGA-5BNC
\$12.00 EA



CD Jewel Case

Replacement for
original case
#TM-CD1
\$.40 each



Parallel Port

DB25 Female to
26 pin socket
#CN-702
\$.50 each



HARD DISK DRIVE COOLER

-IVORY COLOR,
FITS IN 5 1/4" BAY-
TM-FAN-HDD
\$14.00 EA



IEEE-1284 CABLES

10' DB25 TO CENTRONICS
MALE TO MALE
FOR HP, EPSON,
CANON AND OTHERS
CC-PR1-1284
\$9.00 EA



Magnetic Mount Antenna

Standard TNC
connector,
Portable,
12 in. tall,
long cord
ONLY
\$7.50



Andrea

ANDREA HEADPHONES
W/MICROPHONE
-NOISE CANCELLING
MICROPHONE-
-USE WITH LEFT
OR RIGHT EAR-
#TM-165-MONO \$6.00 each



CPU FAN

FOR COOLING
PENTIUM II
PROCESSORS
-BALL BEARING
W/SENSOR WIRE-

Microphone

Stick-on monitor or clip on or
stick on shirt 6 ft. cord;
condenser mic.
#TM-MIC-2
\$2.00 each
100/\$1.00



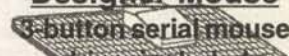
Multimedia

Microphone
Slim-desktop
microphone
TM-MIC-3 \$3.00 EA



Designer Mouse

3 button serial mouse
driver included
TM-290 \$6.00 each



TM-FAN-PENT2

\$16.00 EA

CALL TODAY FOR
A FREE COPY OF OUR
1998 CATALOG WITH
OVER 200 NEW
PRODUCTS!

FLOPPY DISK FILE

HOLDS 100 DISCS
W/ KEYLOCK
#TM-DSC-3
\$4.00 each



1" CASE STICKERS

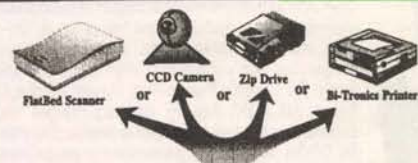
ASSORTED CASE STICKERS
TO PLACE IN EMPTY SPACE
ON FRONT OF
COMPUTER CASES!
ONLY \$1.00 EACH

MULTIMETERS

ANALOG
VOLT-OHM
W/LEADS
TM-325
\$6.00 EACH

DIGITAL
MULTIMETER
W/LEADS
TM-330
\$15.50 EACH

DIGITAL
MULTIMETER
AUTO RANGE
W/LEADS
TM-332
\$59.00 EACH



DS-212-IEEE

IEEE-1284 AUTO SWITCH

1-computer to 2-devices
or
2-computers to 1-device
File transfer feature
no power needed
software included
works with HP printers

\$64.00 EA

NEW



Local 805-295-5577 Remember, We Have Great Connections...For You! FAX 805-295-8777

\$10.00 minimum order required • Add \$4.50 shipping for pre-paid orders

California residents add 8.25% tax • eMail sales@rogerssystems.com

Call for quantity discounts • No out of state checks accepted • Most orders shipped same day!

24895 Avenue Rockefeller, Valencia, CA 91355



OSCILLOSCOPES GOOD condition. **BK 30MHz \$140, Leader 20MHz \$100, Hitachi 20MHz \$85** or offer. 909-612-4523.

MONSANTO PULSE generator 300A, General Radio 1654 impedance comparator, Tek 581 scope, T82 plug-in on cart, North Atlantic indicator 8800, Gertsch synchro standard, Gertsch PT-3R standard ratio, National 5850 counting scale. All surplus to requirements. Will deal, swap or? Don 909-676-7810.

TEST EQUIP: 1308 osc./amp \$850. 1666 \$750. Krohn-Hite 4010 osc. \$250. 1424A \$275. 978-251-3855.

TEST EQUIP: GenRad Noise generators 1381 \$400; 1382 \$400; 1383 \$700. All three \$1,000. 978-251-3855.

WE BUY AND SELL ELECTRONICS TEST EQUIPMENT. A-COMM ELECTRONICS, 7198 SOUTH QUINCE ST., ENGLEWOOD, CO 80112. 303-290-8012, FAX 303-290-8133. HTTP://A-COMM.COM

HTTP://WWW.LABX.COM/AMSL.HTM IN-STOCK used equipment including: laboratory, test & measurement, many other useful items. Most with 15 day guarantee. Andrew Smith 802-254-9459. A.M.S.L., Brattleboro, VT USA.

HP PLOTTERS, HP 7470A, two pen HP-IB, \$200; HP 7475A, RS232, \$150; HP 7046A, YYY plotter, \$500; HP 7035B, \$300; HP 7132A dual channel chart recorder, \$450; Esterline angus speed servo II, \$450; A-COMM Electronics, 303-290-8012. E-Mail: Sales@a-comm.com

OSCILLOSCOPE TEK 2336, 100MHz, portable, very good cond., SASE for 89 catalog pages, \$550. Signal generator, HP 8640B (opt 338) good, \$475, all plus UPS. Frank Moreland, 14788 Poway Mesa Drive, Poway, CA 92064, 619-486-4742.

SERVICE MONITORS: IFR1000A \$2,600, IFR1000S \$3,600. John 504-769-5754.

TEST EQUIPMENT: HP 8656A sig. gen., \$1,750; HP 3325A/002 synthesizer/function gen., \$1,250; HP 8444A/059 tracking gen., \$700; HP 3575A phase meter, \$450; HP 141T/8554B/8552B spec. analyzer, \$1,250; HP 5315B universal counter, \$350; Gen microwave 478 peak power meter, \$2,500. 5 day ROR, call for list. **KDM Electronics.** JASKDM@AOL.COM TEL 219-420-0063, FAX 219-426-0607.

COUNTERS: EIP 451 300MHz to 18.5GHz \$700; EIP 538 10Hz to 26.5GHz \$1,100; HP 5328A, opt. H99 to 512MHz \$225; HP 3455A digital multi-meter \$200. All equipment in good working condition. Charlie @ Trident Engineering 805-642-4329, fax 805-642-2269.

HP EQUIPMENT: 4276A LCZ, 5370A time interval counter, 16500A logic analyzer. Call for best price. Metrowest Technologies. Ph 508-478-7613, fax 508-634-3806, WWW.metrowesttech.com

TEKTRONIX TWD120 digital storage oscilloscope, 100MHz, connects to your PC SCSI port and runs under Windows. Unused in original box, \$495. Used w/accessories, \$395. Includes probes, manuals, software, etc. Visit www.test-equipment.net for details. 732-445-4915.

DO YOU have a Tek 7D15? Get the special RF input cables SMB to BNC female, 2 for \$24.95 ppd. Four Designs, 360-887-1555.

SCOPE CAL STUFF! Tek TG501, opt. 1, \$425; 2901 time mark gen., \$125; Ballantine 6127A w/heads, \$650. Four Designs Co. 360-887-1555.

FOR SALE: Tektronix 7704A scope, with 7A18, 7A18N, 7B53N, \$350; HP power supply model 6266A, \$125; Kikusui oscilloscope 100MHz model COS6100M, \$425; Racial Dana signal generator model 9082P 512MHz, \$600. Call Rob at 215-343-1643, fax 215-343-3000.

LOW-COST ADAPTER FOR YOUR DVM MEASURE CAPACITORS. Uses 1st three DVM scales so that decimal point is in the right place. Also works with auto ranging DVMs. Detailed info: <http://artcahn.com/> <http://cablejus.com/> <http://hypermart.net/> Visa/MC secure order online or by telephone, 1-800-382-8972. Price: \$12.95.

SECURITY

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

ALARM CATALOG of Ademco, Moose, Napco, CCTV & more free. Voice or fax: 732-840-1390 or www.heselectronics.com Get the full 44 page version by sending \$2 to HES Electronics, POB 183, Brick, NJ 08723. Mention this ad and get a \$10 off certificate!

DUAL-PAGE quad switchers 8 camera inputs w/loop-out .3-outputs. Allows you to view 4-cameras on a monitor simultaneously. Built-in video sequencer, plays back quad or full screen images, time & date stamp. Hi-res. Sold for \$700. Dir. now \$350 ea. color quads too. 781-933-0827. E-Mail: ricksvideo@msn.com

SURVEILLANCE EQUIPMENT wanted. Audio, video, RF, countersurveillance, other. Please describe completely in first communication. No junk or CCTV. Fax or E-Mail to Sales@swssec.com fax 410-836-1190. www.swssec.com/used.html

Bearcat Intercepts Trunked Radio

COMMUNICATIONS ELECTRONICS INC.

Now...Monitor trunked radio broadcasts

Save big on radio scanners, weather stations, two-way transceivers and more from CEI during our 29th anniversary. To get your free fax-on-demand catalog dial 734-663-8888 from the telephone handset on your fax machine and follow the recorded voice prompts or visit CEI on the web at www.usascan.com. Get many free benefits such as extended warranty coverage on CEI merchandise when you use your Communications Electronics Platinum Plus Master Card issued by MBNA. No annual fee. Call 1-800-523-7666 anytime and mention offer Q3KI.

Weather Stations



The Weather Monitor II (7440) comes complete with anemometer with 40 feet (12.2 m) of cable, external temperature sensor with 25 feet (7.6 m) of cable, junction box with 8 feet (2.4 m) of cable, AC-power adapter, detailed instruction booklet and one year limited factory warranty.

Now you can be your own weather reporter with the Davis Weather Monitor II. Our top-of-the-line weather station combines the most advanced weather monitoring technologies available into one incredible package. Glance at the display, and see wind direction and wind speed on the compass rose. Ideal for helping plan evacuation orders. Check the barometric trend arrow to see if the pressure is rising or falling. Push a button, and read indoor and outdoor temperature, wind chill, humidity and barometric pressure. Using the Weatherlink with Weather Talker option and your computer, you can issue your own spoken weather reports. Ideal for issuing your own spoken weather reports. Call 734-994-9000 now for live demonstration. Our system can even call you when preset alarm conditions are exceeded. Our package deal includes the new ultra high resolution 1/100 inch or 0.2 mm rain collector part #7852, and the external temperature/humidity sensor, part #7859. Save over \$175 when you order our package deal from CEI. Package deal is order #7440CS-W is \$419.95 plus \$18.00 shipping. If you have a personal computer, when you order the optional Weatherlink computer software for \$134.95, you'll have a powerful computerized weather station at a great price. For the IBM PC running Windows, order part #7862-A. Apple Mac Plus or higher including PowerBook, order part number 7866-A.

Davis Weather Monitor II 7440-A	\$334.95
Davis Weather Wizard II 7425-A	\$149.95
Davis Perception II indoor stand-alone weather monitor 7400-A	\$124.95
Davis Weather Talker 7861-A	\$334.95
Davis Solar Radiation shield 7714-A, helps protect temperature sensor	\$54.95
Davis Remote Display Unit 7815-A	\$84.95
Davis Rain Collector Heater - excellent for winter use 7720-A	\$99.95
Davis Aluminum Rain Collector Shell 7704-A	\$29.95
Davis Rain Collector II 0.01 inch resolution 7852-A	\$59.95
Davis Rain Collector II 0.2 mm 7852METRIC-A	\$59.95
External Temperature/Humidity Sensor 7859-A	\$99.95
Davis Weatherlink Software for IBM PC-Windows version 4.0 7862-A	\$134.95
Davis Weatherlink Software for Apple-Version 3.0 7866-A	\$134.95
Davis 4-Conductor 40' (12.2 m) extension cable 7876040-A	\$17.95
Davis 6-Conductor 40' (12.2 m) extension cable 7876040-A	\$21.95
Davis 8-Conductor 100' (30.5 m) junction box cable 7880100-A	\$44.95
Davis Interface Cable Adapter Module 7760-A	\$59.95
Davis Weather-resistant Terminal Box Shelter 7774-A	\$34.95
Davis Electrostatic & RFI Protected Junction Box 7740-A	\$39.95
Davis Optically coupled Weatherlink Isolator Kit 7764-A	\$39.95
Davis Grounding Kit, helps protect your station - 7780-A	\$19.95
Davis Car/Boat/RV Lighter Power Cord 7873-A	\$9.95
2400 baud modem for Weatherlink MEXT-A	\$29.95
Davis aluminum Sensor Mounting Arm - 7702-A	\$54.95

Radio Transceivers

NEW/RELM®MPV32-A Transceiver

Mfg. suggested list price \$515.00/Special \$299.95
Law enforcement and fire departments depend on the RELM MPV32 transceiver for direct two-way communications with their police or fire department, civil defense agency or amateur radio repeater. The MPV32 is our most popular programmable frequency agile five watt, 32 or optional 64 channel handheld transceiver that has built-in CTCSS, which may be programmed for any 39 standard EIA tones. Frequency range 136.000 to 174.000 MHz. The full function, DTMF compatible keypad also allows for DTMF Encode/Decode and programmable ANI. Weighing only 15.5 oz., it features dealer programmable synthesized frequencies either simplex or half duplex in 2.5 KHz increments. Other features include PC programming and cloning capabilities, scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the MPV32 from CEI, you'll get a complete package deal including antenna, 700 ma battery (add \$20.00 to substitute a 1000 ma battery), battery charger, belt clip and user operating instructions. Other useful accessories are available. A heavy duty leather carrying case with swivel belt loop part #LCMP is \$49.95; rapid charge battery charger, part #BCMP is \$69.95; speaker/microphone, part #SMMP is \$54.95; extra high capacity 1000 ma. ni-cad battery pack, part #BPMP1 is \$79.95; extra 700 ma. ni-cad battery pack, part #BPMP2 is \$59.95; cloning cable part #CCMP is \$34.95; PC programming kit, part #PCKIT030 is \$224.95. A UHF version with a frequency range of 450-480 MHz. part #MPU32 is \$349.95. Your RELM radio transceiver is ideal for many different applications since it is easy to field program with just a screwdriver and programming instructions. The technician programming instructions part #PIMPV is \$18.00. Call 1-800-USA-SCAN to order.

TrunkTracking Radios

Bearcat®235XLT-A TrunkTracker

Mfg. suggested list price \$429.95/CEI price \$269.95
300 Channels • 10 banks • Trunk Scan and Scan Lists
Trunk Lockout • Trunk Delay • Extra battery & charger
10 Priority Channels • Programmed Service Search
Size: 2-1/2" Wide x 1-3/4" Deep x 6" High
Frequency Coverage:
29.000-54.000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat TrunkTracker BC235XLT, is the world's first scanner capable of tracking a selected radio transmission as it moves across a trunked radio system. Now it's easy to monitor fleets and subfleets in analog trunked radio systems. The BC235XLT can also work as a conventional scanner. This 300-channel, programmable handheld scanner provides scanner users with uninterrupted monitoring capabilities of Type I, II, III and hybrid trunking systems. One of the biggest obstacles in the scanner industry has been the increasing use of trunking radio systems in business and public service agencies throughout the U.S. and Canada. This makes it nearly impossible to track a conversation as it moves within a trunk system from frequency to frequency. According to Ken Ascher, WB8LIT, Chairman & CEO of CEI, "The Bearcat 235XLT is a revolutionary breakthrough in scanner technology. Now it's easy to continuously monitor conversations even though the message is switching frequencies." The BC235XLT comes with AC adapter, CRX120 battery charger, two rechargeable long life ni-cad battery packs, belt clip, flexible rubber antenna, earphone, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS and LTR systems. Call 1-800-USA-SCAN to order your scanner.

SW/CB/GMRS Radio

Have fun and use our CB, GMRS and commercial radios to keep in touch with friends. Visit our web site at www.usascan.com for more information or call 1-800-USA-SCAN to order.

Cobra 148GTL-A SSB CB/SPECIAL	\$139.95
Cobra 148FRTL-A SSB CB with frequency counter	\$179.95
Cobra 29WXST-A CB with sound tracker technology	\$149.95
Cobra 2010GTLWX-A SSB CB Base (\$25.00 shipping)	\$299.95
Cobra HH45WX-A Handheld CB radio with weather	\$89.95
Cobra FRS200-A Family Radio Service transceiver	\$89.95
Maxon GMRS210+3-A GMRS transceiver/SPECIAL	\$166.95
RELM RH256NB-A 25 watt VHF mobile transceiver	\$284.95
Sangean ATS909-A portable shortwave receiver	\$229.95

Radio Scanners

Monitor fire, police, weather, marine, medical, aircraft and other transmissions with your Bearcat scanner.

Bearcat 9000XLT-A base/mobile	\$344.95
Bearcat 3000XLT-A handheld	\$329.95
Bearcat 895XLT-A TrunkTracker base	\$319.95
Bearcat 760XLT-A base/mobile	\$179.95
Bearcat 230XLT-A handheld/SPECIAL	\$194.95
Bearcat 235XLT-A TrunkTracker scanner	\$269.95
Sportcat 150-A handheld with 800 MHz.	\$144.95
Bearcat 80XLT-A handheld with 800 MHz.	\$129.95
Bearcat BCT12-A information mobile	\$169.95
Bearcat BCT7-A information mobile	\$149.95
Relm MS200-A computer programmable	\$219.95
Relm HS200-A handheld CTCSS/800 MHz.	\$224.95

DISTRIBUTOR'S COUPON | EXPIRES 7/31/98 | #9804TTR

SAVE \$45 on 1 TrunkTracker

Save \$45 when you purchase your Bearcat 895XLT or BC235XLT scanner directly from Communications Electronics Inc., PO Box 1045, Ann Arbor MI 48106 USA. Telephone orders accepted. Call 1-800-USA-SCAN. Mention offer T74. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase and only on specified product.

Bearcat®895XLT-A Radio Scanner

Mfg. suggested list price \$729.95/Special \$319.95
300 Channels • 10 banks • Built-in CTCSS • S Meter
Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High
Frequency Coverage: 29.000-54.000 MHz., 108.000-174 MHz., 216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions (see BC235XLT description) with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include Auto Store - Automatically stores all active frequencies within the specified bank(s). Auto Recording - This feature lets you record channel activity from the scanner onto a tape recorder. CTCSS Tone Board (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: PS001 Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter \$14.95; PS002 DC power cord - enables permanent operation from your vehicle's fuse box \$14.95; MB001 Mobile mounting bracket \$14.95; EX711 External speaker with mounting bracket & 10 feet of cable with plug attached \$19.95. Comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty.

Buy with confidence

It's easy to order from us. Mail orders to: Communications Electronics Inc., P.O. Box 1045, Ann Arbor, Michigan 48106 USA. Add \$18.00 per weather station or radio product for UPS ground shipping, handling and insurance to the continental USA unless otherwise stated. Add \$12.00 shipping for all accessories and publications. Add \$12.00 shipping per antenna. For Canada, Puerto Rico, Hawaii, Alaska, Guam, P.O. Box or APO/FPO delivery, shipping charges are two times continental US rates. Michigan residents add state sales tax. No COD's. Satisfaction guaranteed or return item in unused condition in original packaging within 61 days for refund, less shipping charges. 10% surcharge for net 10 billing to qualified accounts. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. We welcome your Discover, Visa, American Express, MasterCard, IMPAC or Eurocard. Call anytime 1-800-USA-SCAN or 800-872-7226 to order toll-free. Call 734-996-8888 if outside Canada or the USA. FAX anytime, dial 734-663-8888. Dealer and international inquiries invited. Order from Communications Electronics Inc. today and save. Price schedule effective April 5, 1998. Add #940588NV ©1998 Communications Electronics Inc.

For credit card orders call

1-800-USA-SCAN

Communications Electronics Inc.
Emergency Operations Center
email: cei@usascan.com
www.usascan.com

PO Box 1045, Ann Arbor, Michigan 48106-1045 USA
For information call 734-996-8888 or FAX 734-663-8888

SATELLITE EQUIPMENT

SATELLITE EQUIPMENT available: Receivers \$25 and up; 20-25 LNB \$30; C-KU feed horns \$65. Call 757-599-4408.

USED SATELLITE EQUIPMENT. You name it, we have it. LNAs, downconverters, drives, receivers. Working condition guaranteed. Call 765-385-2305.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

FREE SATELLITE TV CATALOG. Tech books, installation videos, analysis software 1-800-843-2425 or www.baylin.com



BEST PRICING on 18" satellite TV systems for home and RV. DSS, DISH Network programming, multi-room viewing options, accessories. www.skyvision.com Call 1-800-543-3025.

SEE WORLD SATELLITE, 1-800-435-2808. DISH NETWORK complete system ONLY \$179. FREE INSTALL KIT, FREE SHIPPING, 30 DAY MONEY BACK GUARANTEE.

DSS TEST CARD information. Call toll free, 1-888-416-7296.

WHAT! YOU don't have TELECODE'S NEW 1998 "HACKERS CATALOG," yet! 125 + items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>



FREE BIG dish catalog. Low prices! Systems, upgrades, parts, and "4DTV." Skyvision, 1010 Frontier Dr., Fergus Falls, MN 56537. www.skyvision.com Call 1-800-543-3025.

MILITARY SURPLUS ELECTRONICS

MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quiksand/goldtek.htm

AUDIO - VIDEO - LASERS

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

WANTED: TOP CASH/REWARD FOR YOUR DBX Sub-Sonic synthesizer! Antique Video Transfer Service, 5001 Diamond Hts. Blvd., San Francisco, CA 94131-1621, 415-821-3359 fax 415-821-7500.

WANTED: PRO video equipment, VTRs, switchers, cameras, etc. Advanced Media 1-800-722-7468 ext. 2575.

ANA Instruments

Phone: 1-800-944-0495

Fax: (540) 775-9638

E-Mail: anainstr@crosslink.net

Specials

HP 141T CRTs, New in Box.....\$195.00
HP 8657A Signal Generator.....\$4,500.00
100 KHz-1040 MHz
HP 8640B Signal Generator.....\$2,100.00
Opt. 001, 002, 003
Gigatronics 600 .01-8 GHz.....\$2,400.00
HP 86222A .01-2.4 GHz.....\$1,100.00
HP 8903B Audio Analyzer.....\$2,700.00
HP 8901B Modulation Analyzer.....\$3,700.00
HP 8902A Measuring Receiver.....\$17,500.00
HP 436A Power Meter w/Cable.....\$1,400.00
Tek 492 Opt 1,2,3 Spec. Analyzer ..\$6,200.00
Sanders 5440C Noise Figure Meter...\$400.00
(new)

Wanted

RF & Microwave Test and Measurement Equipment & Components

Electronic Test Equipment Bought and Sold
Visa and MasterCard Accepted

MICRO VIDEO CAMERAS




MB-750U & MB750P
Video Cameras
your Choice
\$89.95

- 1.25" sq.
- .1 LUX
- 420 TV Line

The Best, Smallest, Micro Cameras on the Market Today!
Call and Compare! We Match or Beat All Prices!




AFFORDABLE LIPSTICK CAMERAS



Length: 1.9"
Diameter: .91"

LP-850i - \$119.95



Length: 1.37"
Diameter: .87"

LP-850p - \$129.95

These cameras are supplied with a PCM-1 Video/Power cable. The RCA female connection is for standard video connection to a Monitor or VCR, Video signal -75 ohms at 1 volt peak to peak NTSC. The power is supplied to the camera by a 2.1mm barrel connector, 12 VDC center positive.

NIGHT VISION



Night Vision Scope w/ Illuminator
Fun to use, Low cost.
3.6 x 85mm f1.6
MI-PR100 - \$399.95

WIRELESS VIDEO CAMERAS

Compatible with AC or Battery

Transmits Over 1000 ft.

GFT-1001 \$189.95
Gives any camera the ability to be Wireless.
Transmits Over 1000 ft.

GFT-1001 \$189.95

Wireless 4-Channel B/W & COLOR Cameras Available!
Plug and Play Readiness

MICRO COLOR CAMERAS



Size: 1.25 x 1.25 sq. w/ Footprint

Micro Color MB-950C: \$299.95

- Wide Voltage Range, 5-14 Volts!
- Small Footprint!
- Self contained ultra small package design for various applications.
- MCM PCB design for minimizing the size and improve durability.



Size: 1.7 x 1.7 sq. x 2 PC Board

Micro Color MB-960C: \$199.95

- Lens: 3.6mm F=2
- Full Digital Process of BLC
- Auto Tracing White Balance
- 2H Mode of H.V. Aperture correction
- Digital process of color matrix
- Electronic Shutter up to 1/10,000
- Dip Switch Adjustment settings: 6)-BLC, 5)-Auto Shutter, 4)-AGC/On, 3)-Flickless, 2)-AWB/On, 1)-N/A



MB-1281 Color Camera

- Color module of 290,000 pixels 1/4" CCD
- 320 Horizontal Res. TV Lines
- DSP (Digital Signal Processing)
- Built-in Functions:
 - Auto Gain Control
 - Auto White Balance
 - Electronic Shutter
 - Back Light Compensation
- Power - 12VDC @160mA
- Low Power Consumption



Wireless Observations System's
GFS-1001 (900MHz) - \$499.95
GFS-1001c (900MHz) - \$599.95
(1.2 Ghz system's available)

1-800-752-3571

Visit Polaris Ind. Web Site at:
<http://www.polarisusa.com>

Polaris Industries 470 Armour Drive NE • Atlanta GA 30324 • Tech Info: 404-872-0722 • FAX 404-872-1038

Prices, availability and specifications are subject to change without notice. Shipping and Handling are not included with price.

SYNC-A-LINK UNIVERSAL VIDEO SYNC GENERATOR restores all horizontal & vertical sync lines, DC level, compensates for inverted video, color phase, from standard or distorted analogue video-type formats. Comes complete with operations manual & 90-day warranty. \$160. 918-479-6451 or write to Sync-A-link Communications, PO Box 4, Locust Grove, OK 74352.

MOD CHIPS for Sony PlayStation. Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. www.cconusa.com

UNIQUE VIDEO PRODUCTS: Pattern generators with char. ID, color black, switchers, reference osc., distribution amps, video conversion, etc., kits also available. FREE catalog, GEKCO Labs, PO Box 642, Issaquah, WA 98027-6730, 425-392-0638, www.gekco.com

1310NM InGaAsP DFB long haul fiber-optic telecom lasers with optical isolator, integrated thermoelectric cooler and pig-tails, butterfly package, various manufacturers \$600. 207-493-3300.

SONY PLAYSTATION mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

SONY PLAYSTATION: Electronic wholesaler now has Mod PICs in stock! The PIC lets you play import & CD-R back-up copies, protect your investment! Don't pay high prices from others! We have the lowest prices period! 1-9 \$10 ea., 10-19 \$9 ea., 20-29 \$8 ea., 30-39 \$7 ea., 40-49 \$6 ea., 50+ \$5 ea. Please send check or money order to the following address: Electronic Wholesalers, PO Box 1035, Reynoldsburg, OH 43068. Please add \$3 shipping on orders below qty. 10. We also ship 2-Day Priority mail (add \$5). Visit our website at <http://www.ezthrill.com> for software and full documentation or call us at 614-260-1906.

WANTED PIONEER 5XXX-6XXXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

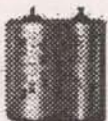
AUDIO AMPLIFIERS, class AB using two APEX PA12A power op-amps, 120 watt RMS @ 4 ohm, 40 to 15KHz when filter is jumpered. (Makes excellent sub woofer amp.) Complete with chassis 10-1/2" x 6-1/2" x 3-1/2" including large heatsink, MS310218A11P & plug requires 48-72 VDC. With schematics, \$75 each. 816-587-0000 x 235 or Tom@VMI-KC.com

BROADCAST VIDEO equipment wanted: all types, new or old. Please call, Jon with info. 1-800-539-2859.

for other neat stuff surf the internet
www.gatewayelec.com

Geophone

vibration sensing kit
Detect a fly stomping
across the desk!
Well maybe not that
sensitive, but almost.
These vibration sensors
made by Geosensor® were used in oil
exploration to determine geological
statistics. They are made with a
magnet suspended in a coil and are
very sensitive to vibration. Compact
size, the unit measures approx. 1.6"
high and 1.2" dia.
The kit includes a geophone vibration
sensor along with parts to build a
basic detector that will light an LED. In
addition we include a schematic that
will show you how to operate a relay.
The sensitivity is adjustable, so you can
set it to detect elephants and other
small creatures. Similar units were
used by our armed forces to detect
enemy troop movements...the perfect
device to alert you to the pitter patter
of little Leroy's feet! Unit sensitivity
can be set high enough to detect a
business card dropped on a table,
and we've made it work with
vibrations up to 40 feet away!
Earthquake or Aunt Agatha
...you decide!
It's a fun gadget with many uses.
GEOSENSOR KIT....\$ 9.95



AMAZING MINI MICRO STEREO FM RADIO! \$7.50

**Much lighter than a
heavy jam box with
really good sound!**
**This tiny radio
(1.5"x1.06"x0.38") has a seek
button, reset control, and an
on/off switch.**
**Personal listening has never
sounded better!**
**Ideal for ballgames, studyhall,
and workouts.**
**Battery and nugget style
earphones included.**



LCD DIGITAL VOLTAGE TESTER \$4.95

This tester is suitable for
measuring 12-220 VAC and
DC directly as well as mea-
suring the ground line, phase
line, and the breakpoint
of the AC indirectly.
Pocket size tester fits
almost anywhere - great
for toolbox, bench,
home, or pocket!



Are your batteries feeling tired and worn-out?

Call Dr. Nicad, The Nicad Battery Conditioner!
With this kit, you can build a rapid charger that eliminates memory effect and brings many
batteries to full charge in less than an hour! Charge NiCad or NiMH packs from 2 to 10 cells
(easily expanded) and current capacities up to 10 AH. Runs on 12-15 VDC. Features a
switch-mode regulator that controls constant current charge while being monitored by a
negative delta-V system that cuts off the fast charge at the exact point of full charge so your
batteries don't get cooked! Dr. Nicad Kit \$49.95 Optional Matching Case \$14.95

CD STONE CD-ROM/CD AUDIO Multiple use benchmark, test and utilities CD Disc \$7.95

CD-STONE measures throughput and access time in a highly reliable and
consistent manner, producing a meaningful benchmark for CD-ROM
drives. This CD disc will help you obtain maximum performance from
both stereo audio systems and your computer's CD-ROM drive.
CD-STONE includes tests for MPC levels 1 and 2 plus full audio
reference playback facilities for the true audiophile with many options
including Dolby Surround Sound tests, phase and frequency response
tests in 2 formats, Windows (.WAV) format and in Real Audio format for
use in both home and mobile stereo audio systems.
Additional utilities include extended drive and media information viewers
with support for data capture. One of our best sellers!

PHOTON II MICROLIGHT

The popular photon microlight has been improved. These
super-bright (better than 8 candellas!) LED lights are
visible over a mile away. The LED is secured in a
tough ABS case and offers a squeeze button for quick
use, and a constant on slide switch for prolonged
lighting needs. The lithium batteries last a very
long time (10 year shelf life!) and are included. The
light won't burn out because it is an LED! Specify your choice
of five incredible bright colors. Great for home or office use,
popular with fire and rescue professionals, pyrotechnicians,
stage performers, and dimly lit restaurant patrons. PHOTON
II microlights include a keyring and come in ruby red (\$13.50),
amber yellow (\$13.50), sapphire blue (\$17.50), diamond white
(\$17.50), and emerald green (\$17.50). Includes two replaceable
2016 lithium batteries.



VX1-R CASE \$12.50

We had a case designed specifically for the popular
little Yaesu HT. A fully adjustable case made of a
durable polypropylene web material, it features an elastic
side slot to store your spare battery or drycell case
(some aftermarket antennas fit well here too!), a
heavy-duty velcro closure to keep your radio secure
yet accessible, and a super strong velcro belt loop to
attach conveniently to your belt. Case fits several
other radios including the VXF-1 FRS radio from
Vertex. (Note: Elastic side slot may not be
appropriate for batteries on other radios.) A great
case at a very affordable price! Yes, we do sell the
Yaesu VX-1R as well as many other popular
Yaesu, Kenwood, Icom and Alinco radios!

THE FINE PRINT: PRICES SUBJECT TO CHANGE
WITHOUT NOTICE * GATEWAY IS NOT RESPONSIBLE
FOR PRINTING ERRORS * MASTERCARD, VISA AND
DISCOVER ACCEPTED * YES, WE'LL TAKE YOUR
CHECK - SORRY, NO C.O.D.s * \$10 MERCHANDISE
MINIMUM ON MAIL ORDERS * SUPPLY OF SOME
ITEMS IS LIMITED * PRICES DO NOT INCLUDE
SHIPPING * UPS GROUND SHIPPING/HANDLING
WITHIN THE CONTINENTAL U.S. (ITEMS REQUIRING
ADDITIONAL AMOUNTS ARE NOTED)...\$4.25 FOR
THE FIRST ITEM, \$0.50 FOR EACH ADDITIONAL ITEM.
RESTOCKING CHARGE MAY BE ASSESSED ON RETURNED
ITEMS. I want to die in my sleep like my grandfather...not screaming
and yelling like the passengers in his car!

BE A FLY ON THE WALL!!!

Well, actually, those little wings
would look pretty stupid on you,
but you can build a miniature "bug". Surface mount
technology is the latest techno-buzz word, and a
challenging new frontier for kit builders. The
manufacturer understood that the first try might
be a bit rough, so they included enough components
to assemble two units. (so it is o.k. to lose or
damage a SMT component!) With the entire FM
broadcast band (from 88 - 108 MHz) for your
receiver, and a transmit range of 300 feet, even
James Bond would like this kit! This unit is powered
by a 1.5 volt watch battery (included) and features
an electret type high gain microphone for superior
audio quality and extended pick up range - hear a
whisper at 10 feet.

A lot of fun in less than a square inch!!!
Micro Size FM Wireless Transmitter Kit \$19.95

gateway
ELECTRONICS, INC.

8123 PAGE BLVD
ST. LOUIS, MO 63130
(314)427-6116

9222 CHESAPEAKE DR.
SAN DIEGO, CA 92123
(619)279-6802

2525 FEDERAL BLVD.
DENVER, CO 80211
(303)458-5444

MAIL ORDERS CALL
TOLL-FREE
1-800-669-5810

FAX ORDERS (314)427-3147

CABLE TV

UNMODIFIED JERROLD Pioneer, SA
and Panasonic Model 175 multivision.
We carry all other cable products. Please
call between 7-9 pm EST. 617-389-5155.

**CABLE TV. ALL MAJOR NAME
BRANDS. 30 DAY MONEY BACK, 1
YEAR WARRANTY, BEST PRICES.
OPEN 8-9 MON-SAT. T & L SERVICES
1-888-823-6047.**



NOTCH FILTERS 110, 108.5, 106.5,
97.5 75dB deep notch. \$19.95 ea., 1-5
qty. \$15.95 ea., 6-10 qty. \$11.95 ea., 11-
20 qty. \$9.95 ea., 21 or more qty. Call 24
hr. order and information hot line 516-
389-3536.

ATTENTION: YOU'VE tried the rest,
now go with the best. **UNICORN
ELECTRONICS** where our valued
customers **ALWAYS** come first.
**CABLE CONVERTERS AND
ACCESSORIES.** We will beat all
competitors prices **GUARANTEED.**
All units in **STOCK** for **IMMEDI-
ATE SHIPMENT.** FREE batteries and
coax cable. **FREE** bullet protection
with every unit purchased. **FREE**
shipping with a \$500 purchase or
more. **NO COD** charges. **ALL** prod-
ucts come with a 1 year warranty and
a 30 day money back guarantee.
Please give us a call TOLL FREE 1-
888-738-8181 9am to 6:30pm EST.
VISA, M/CARD, DISCOVER, COD.
UNICORN Electronics does not advo-
cate unauthorized use or theft of
cable services.

CABLE CONVERTERS, remotes, etc.,
free flyer. Jake 1-800-879-9657.J

**ERROLD UNMODIFIED CONVERTERS
FOR SALE. CALL FOR BEST PRICES.
NO DESCRAMBLER SALES. CALL
BRLD ELECTRONICS 1-800-322-6316.**

PC BOARDS REPAIRED. Prices start at
\$5. Minimum 25 of one type. Network
Sales, 616-683-0500.

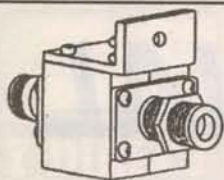
PICS, GALS READ if you've lost your
masters. Programming service available.
Call for info. Network Sales, 616-683-
0500.

DEALERS WANTED. New product, new
boxes. For all your other cable and
accessory needs, please call 1-800-370-
0801. All equipment carries a 1 yr. war-
ranty and 30 day money back guarantee.

**WANTED: RAW & unmodified cable
converters.** Please call 1-800-370-
0801.

CATV REPAIR, most models, great
prices, warranty included. We sell equip-
ment: Wavetek, model 1910-1405 oscil-
loscope 60MHz. Please call 619-280-
5698, beeper 619-214-6108.

I WANT to buy any quantity in any condition: CFT 2254, CFT 2024, CFT 2014, Jer BB7, DPV 7, Pioneer 5135, 6100, 6300, and SA 8590, 8600. Call 702-79C-TECH Mon-Fri 9-6.



EXPLOSIVE CABLE TV GRAB! BRINKER ZAPPER/SNOOPER STOPPER combo module all in one! Buy wholesale factory-direct, no middle-man. Let others get fined + zapped instead. 100% COMPATIBLE. Your order shipped NATIONWIDE immediately! **LIFETIME GUARANTEE!** VISA/MC/AMEX/COD/MO/CHECKS. ONLY \$10 (SPECIAL: 3/\$20 plus FREE DESCRAMBLER PLANS!). **SUPER ZAPPER MODULES ONLY \$16!** (3/\$33)! Use **SUPER ZAPPERS** if you have COX, TCI, WARNER in: CA, TX, FL, NY, PA, MI. **FREE SHIPPING. OPEN 24 HOURS!** 352-429-5496 ext. 100. **BRINKER ENGINEERING LABS, USA.**

CABLE CONVERTERS: unmodified, Jerrold, Scientific Atlanta, Zenith, Pioneer, Tocom, Panasonic, quality units at great dealer prices. Call now for specials 702-270-4351.

CLOSE OUT: ALL UNITS RAW AND UNMODIFIED: Zenith ST1000, 1086, 1110, 5010 and ST6700s. Zenith ST1622, SA 8500, 8520, 8525, 8528, 8530 and 8540s. SA 8550, Jerrold DRZs. Prices based on orders of 200 or more. 1-800-380-9530.

ZENITH 73ch unmodified ST16XXS complete as-is \$60 each; refurbished \$90. 10 lot min 702-270-4341.

CABLE! SATELLITE! If you repair these items, we have torn apart, reverse engineered, and drawn schematics of 300+ items. Latest draws: 8610X series, BA-63XX series, MM-5201, BA-V1040. Send \$5 (refundable with order). Ask for **TELEVISION** catalog. For list of our other 20 catalogs, visit our web site. **BOMARC SERVICES**, Box 1113, Casper, WY 82602, 307-234-3488. **ROLLO@TRIB.COM**

WE BUY raw unmodified cable converters, line gear and head-end equipment. Any quantity-most models. Call with your inventory. 1-800-380-9530.

ZENITH ST-1000 complete as-is \$50, ST16XX 99 ch refurbished \$95. 702-270-4341.

UNMODIFIED CABLE CONVERTERS. Zenith ST1600, ST1086, ST300, Panasonic 175, 145 vol. & non-vol. Regal RR-92 & RC 83, DP5, DP7, DRZ, 5503 VIP, SA 8580. Guaranteed low prices. Please call for more converters 405-631-1856.

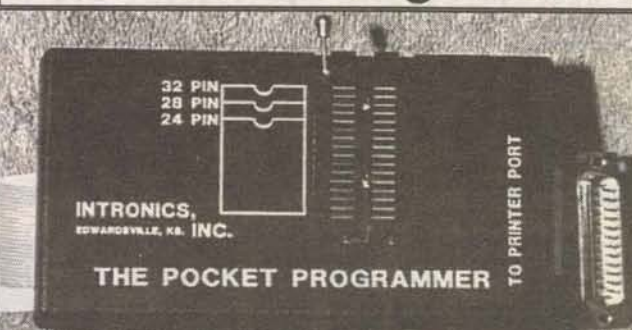


CABLE MANUFACTURERS. Call Toggle Switch Supermarket, wholesale prices, free list. Fertik's, 5400 Ella, Philadelphia, PA 19120 Ph/Fax: 215-455-2121.

PLANS: DESCramBLE CABLE FOR UNDER \$12. PLUS TWO FREE BONUSES. TOLL FREE 1-888-588-3715.

ADEAL4U WHOLESALERS BIG SAVINGS \$\$\$ BEST QUALITY - NO CHEAP CLONES 888-387-1248 www.adeal4u.com

The Pocket Programmer



The portable programmer that uses the printer port of your PC instead of an internal card. Easy to use software that programs E(E)prom, Flash & Dallas Ram. 27(C)/28(C)/28F/ 29F/29CXXX & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, MCU's 874X, 875X, 40-Pin X 16 & Serial Eprom's, PLCC, 5-Gang, 82/74 Prom's and Eprom Emulator to 32K X 8. Only \$129.95

Same Name, Address & Phone Number for 16 Years.... Now isn't that Amazing ?

Intronics, Inc.

Box 13723 / 612 Newton St.

Edwardsville, KS 66113

Tel. (913) 422-2094

Add \$5.00 COD

Add \$4.00 Shipping

Fax (913) 441-1623 Visa / Master Charge / Amex

Cables/Wire Harnesses Circuit Boards & Electro-Mechanical Assemblies

Quick turn around ♦ Prototype To
Production ♦ Affordable pricing
♦ on-time delivery

Well Equipped Plant

Please Call for more information

PH: 847-616-0011 FX: 847-616-0015



**Manu
Industries, inc**
2645 American Lane
Elk Grove Village
IL 60007

Write in 187 on Reader Service Card.

"TOP OF the line" Panasonic TZPC with volume refurbished only \$69; Regal: CR-83V volume, STD/HRC parental lock, last channel recall, good for all Boss, \$45; Panasonic TZPC-145, \$45. Minimum 10-lot. 1 full year warranty. Call: 405-634-1535.

WANTED PIONEER 5XXX-6XXXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

MOD CHIPS for Sony PlayStation. Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. www.cconusa.com

FREE CABLE DESCramBLER PLANS! For details write: Sierra Publishing, 909 E. Yorba Linda Blvd., Suite H-181, Dept. NVD, Placentia, CA 92870.

CALL ALEN for all your cable needs or computer software, PICs, GALs read if you've lost your masters. Programming service available. For info call 909-941-4858 or E-Mail to alencable@aol.com or visit us at our web on site <http://members.aol.com/alencable>

ONE STOP shop. We carry a full line of CBTv equipment for all your cable needs. Also a wide variety of converter parts and accessories. Call for free catalog: 405-631-5153, FAX: 405-631-4788.

FOR THE BEST PRICES ON PROFESSIONAL TOOLS, CALL ELECTRO-TOOL



platt - Case - Deluxe Polypropylene. Chemical Resistant. Tools by CooperTools and others. 800T Case, complete with tools ... \$419.95
800T Case Only ... \$121.80

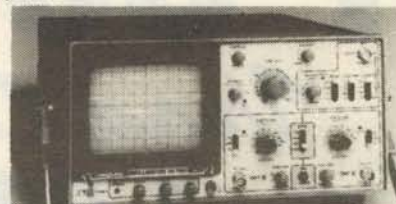


platt - Case - Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools ... \$223.00
660ZT Case Only ... \$59.45
Optional Sperry meter #DM6510 as shown ... \$65.00



Weller WCC100 - Electronically controlled station, temperature adjustable from 350°F-850°F, Zero voltage circuit-safe for sensitive components, 40 Watt pencil ... \$97.90

OptiVISOR - Superior magnification, Optical Glass Prismatic lenses (not plastic). Select any one of (6) magnifications ... \$24.00



GoldStar - 20 MHz Dual Trace Oscilloscope OS-9020A-Large 6" rectangular, high sensitivity: 1mV/div, high accuracy: ±3%, stable, low-drift design, 8 divisions of displayed dynamic range and accurate, distortion-free waveform measurements ... \$372.00

Electro Tool, Inc.



9103 Gillman, Livonia, MI 48150
Customer Service: (734) 422-1221
ORDERS ONLY: 1 (800) 772-3455
FAX: (734) 422-3432



"Tools American Made."

Write in 74 on Reader Service Card.

ATTN: CABLE converter repairer. We stock-up most converter parts like: Tocom, Pioneer. Call for Zenith transistor saw filters, converter cases, lens and all other parts. Minimum order \$50. Call: 405-634-1535.

CBTV REPAIR. We specialize in all converters, including Zenith. Give us a call: 405-634-1535.

SIGMA ONE, 3D, 2000, and 2001 unmodified cable boxes avail. \$125+ 808-949-5410. No descrambler sales!

CABLE CONVERTERS and supplies, shop no more, best prices and tech support. Extreme Electronics 1-888-609-4910.

TONY TALLI'S ORIGINAL TELEVIEW DISTRIBUTORS

WHERE OUR VALUED CUSTOMERS' BUSINESS
IS HONESTLY APPRECIATED

**SERVING YOUR CABLE
NEEDS SINCE 1984**

1-800-847-3773

Vega One **ORDERS ALSO ACCEPTED**

Not
affiliated
with NCCA.

1-800-525-0428 P.M. SALES

Orders called in by 1:00 pm shipped same day. \$15 shipping.
NO NEVADA SALES • Hours: M-F 9-4 PST



FREE
1 YEAR
SUBSCRIPTION TO
NUTS & VOLTS
WITH \$500.00
MIN. ORDER

FREE Golf Hat with \$150 purchase.
FREE T-Shirt with \$500 purchase.

Call for this month's Nuts & Volts Specials

**YES!
WE HAVE
COUPONS!**

GIVE TELEVIEW TONY A CALL TODAY!
1-702-253-1852 • FAX 1-702-253-1854

P.O. BOX 71465 • LAS VEGAS, NV 89170-1465



*For all your cable needs
Call us first!*

**SIX-MONTH GUARANTEE
(30-DAY MONEY BACK)**

**Phone 630-616-8050
or
Fax 630-616-8094**

For orders only: 1-800-742-2567

HOURS: MON.-FRI. 8-6 CST • SAT. 10-2 CST

Greenleaf Electronics • P.O. Box 538 • Bensenville, IL 60106

ATTENTION DEALERS

BUY DIRECT FROM THE WHOLESALE

GET THE BEST PRICES AND SERVICE
ALL UNITS ARE IN STOCK FOR IMMEDIATE SHIPMENT

CABLE CONVERTERS AND ACCESSORIES

CALL FOR PRICING ON ITEMS NOT LISTED

	QTY 5	QTY 10	QTY 25	QTY 50	QTY 100
NEW CONVERTERS					
CENTURY CT-3000	\$68	\$64	\$60	\$55	CALL
COMMERCIAL-11	\$75	\$70	\$65	\$62	CALL
PANASONIC-1003	\$55	\$49	\$48	\$46	CALL
DIGITECH-550 MHZ	\$55	\$49	\$48	\$46	CALL

NOVAVISIONS					
NV-5600	\$175	\$170	\$165	\$155	CALL
NV-5700	\$175	\$170	\$165	\$155	CALL
NV-5800	\$175	\$170	\$165	\$155	CALL
NV-6600	\$269	\$249	\$239	\$229	CALL

REFURBISHED CONVERTERS					
PANASONIC-145R	\$55	\$50	\$42	\$38	CALL

1-800-800-0766

KIMTRONIX

30 day money back guarantee. All shipping and handling at customers expense. Anyone implying theft of cable service will be denied sale. NO FLORIDA SALES. WE WILL MEET OR BEAT ALL COMPETITOR'S PRICES IN THIS MAGAZINE.

Write in 75 on Reader Service Card.

ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT

Visit www.alfaelectronics.com for complete info

1-800-526-2532



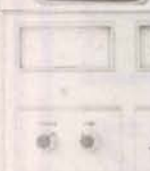
DMM
DMM-89S (\$179.00): true rms, AC/DC (V,A), Ω , bar graph, freq, capac., dBm, logic, diode
DMM-23T (\$99.95): 4 1/2 digit, true rms, high resol. (10V, 10nA, 10M Ω), hFE, diode, contin.
DMM-20 (\$74.95): AC/DC (V,A), Freq, cont., Capac, Induct., Ω , hFE, diode, duty cycle
DMM-122 (\$59.95): DC/AC (V,A), Ω , hFE, diode, capacitance, freq, logic, continuity
DMM-123 (\$44.95): DMM + capacitance, DC/AC (V,A), Ω , hFE, diode, continuity
DMM-10 (\$19.95): 3 1/2 digit, DC/AC V, Ω , hFE, diode, signal output (+3V, -0.5V, 50% duty)



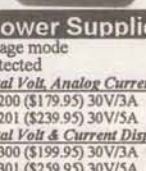
COR/COUNTER
CAP-15 (\$49.95): 3 1/2 digit, 0.1pF-20mF, 9 Ranges, 0.1pF resolution, zero adjustment.
LCR-24 (\$139.95): 0.1uH-200H, 0.1pF-2000uF, 0.01Q-20M Ω , diode test. New Model.
LCR-131D (\$219.95): autorange, 0.1uH-10kH, 0.1pF-10mF, 1m Ω -10M Ω , Q Factor, serial/parallel, 120Hz/1kHz testing mode.
FC-1200 (\$129.95): 1.25GHz Handheld, 8 digits display, 10ppm accuracy, sensitivity 5mV (130-350MHz), 30mV (440MHz)

FLUKE
12B \$ 84.95
70-III \$ 85.00
73-III \$115.00
75-III \$139.00
77-III \$154.00
79-III \$175.00
87-III \$309.00
92B-III \$1,445
96B-II \$1,695
99B-III \$2,095
105B \$2,495
123-III \$945
863E \$475
867B \$650

SPECIALTY
AC Current Probe \$34.95
DC/AC Current Probe \$79.95
Mini AC Clamp \$59.95
AC Clamp w/temp \$89.95
AC/DC Clamp \$109.95
Thermometer \$69.95-\$89.95
IR Thermometer \$189.95
Sound Level meter \$169.95
Tachometer \$169.95-\$219.95
EMF Tester \$69.95
Pressure meter \$299.95
Watt Meter \$129.95
High Voltage Probe \$59.95
pH Meter \$79.95
Light Meter \$80-\$90



Single Output DC Power Supplies
• Constant current, constant voltage mode
• Short Circuit and overload protected
Analog Meters Display
PS-303 (\$159.00) 30V/3A
PS-305 (\$219.95) 30V/5A
PS-8112 (\$399.95) 60V/5A
PS-1610 (\$289.00) 16V/10A
PS-8107 (\$399.95) 30V/10A



Triple Output
• Independence or Tracking operation
• Parallel to double current output (PS-8102 & PS-8103 only)
Triple Output (Analog displays)
PS-8102 (\$399.95) 30V/3A/30V/3A
PS-8103 (\$489.95) 30V/5A/30V/5A
Digital Displays
PS-8202 (\$499.95) 30V/3A/30V/3A
PS-8203 (\$549.95) 30V/5A/30V/5A

AUDIO/RF/FUNCT. GEN.
RF Generator • SC-4160 (\$124.95) 100kHz-150MHz sinewaves in 8 ranges
• SC-4162AD (\$229.95) with 6 digit counter
Audio Generator • AG-2601 (\$124.95) 10Hz-1MHz, 0-8Vpp sine, 0-10Vpp squarewave
• AG-2603AD (\$229.95) with 6 digit counter
Function Generator • FG-2100A (\$169.95) 0.2Hz-2MHz, 5mV-20Vpp
• FG-2103 (\$329.95) Sweep 0.5Hz-5MHz

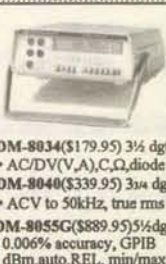
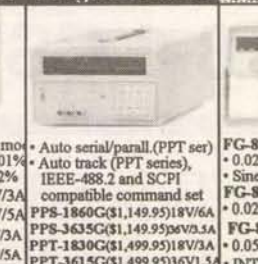
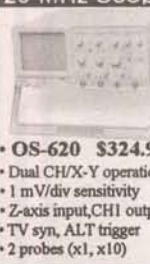
GW/INSTEK

20 MHz Scope
Cursor Readout
Triple Output
Single Output
Programmable

DC POWER SUPPLIES

FUNCTION GENERATOR

BENCHTOP DMM



ALFA ELECTRONICS P.O. BOX 8089 PRINCETON, NJ 08543
TEL: (800)526-2532 / (609) 897-1135
FAX: 609-897-0206
E-mail: alfa0168@aol.com
Call / Write / Fax / Email for FREE CATALOG
Visa, MC, AMEX, COD, PO Accepted. OEM Welcome.
1 Year Warranty (2 Years for GW/Instek)

CABLE TV cont.

WE PROGRAM 16Cs, 68HCs, 16V8, 22V10, 2764 EEPROMs for your electronic needs. 30 days money back guarantee. KCS 1-800-879-8820.

SONY PLAYSTATION mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

EVERYTHING YOU need for CABLE and more. Parts & accessories. Best prices & quantity discount. WE DON'T SELL BOXES. 1-800-MODULE-0.

VISIT OUR WEB SITE AT WWW.ALLCABLE.COM

CONVERTER REPAIR PARTS, CASES, TUNERS, REMOTE CONTROLS, AS LOW AS \$1 EACH. 407-676-2530. NO FLORIDA SALES.

ENGINEERING SERVICE. MEMORY DEVICES PROGRAMMED, AND MUCH MORE. 407-676-2530.

LARGE QUANTITIES: RAW UNMODIFIED UNITS Pioneer 5000, 6000 series. Zenith 1600 series. SA-80s and up. Jerrold-DPV, CFTs. Tocom-O7S plus other models & manufacturers. Call for Pricing. 1-800-380-9530.

LOOKING FOR a good low cost plain converter like: Plo 4135 70 channel or brand new Centurion CF-3000 550MHz \$65. Also "raw" genuine unmodified units: Tocom 5503 VIP, \$45; DP5, \$55; DP7, channel 2, \$59; Zenith ST 1600, \$75. 405-634-1535.

ACTIVE INDUSTRIES manufacturer of cable related products. 1-800-305-6878.

PIONEER CONVERTER BOXES 619-667-9252.

CAROLYN'S ELECTRONICS. 125 channel volume control. 100 @ \$70, 50 @ \$75, 20 @ \$80, 10 @ \$85. We will not be undersold. 607-732-6711.

NEW A,B switch for Tocom \$9 each, video cassette storage cases: \$1 each, minimum order 50-lot. FM trap filter \$5. 405-634-1535.

Closing Date For Next Issue - June 5th!

TELEPHONE/FAX

EXTENSION PHONE LOCKOUTS. Prevent trashed downloads and FAX blasting. Easily installed with screwdriver. 99 cents each plus \$6.50 per order. Docs included. SYNERGETICS SURPLUS, Box 809, Thatcher, AZ 85552. 520-428-4073. VISA/MC. synergetics@tinaja.com

BEEPER, TWO-WAY radio repairs, modifications, duplications, all models, test equipment. Call TJ 718-341-1849, Fax 718-978-4616.

BLUE BOOK PHONE REPAIR. 1000 models answering machines, cordless, wired, \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

TELEPHONE CATALOG of Panasonic, SWB, Intertel and more, including alarm systems, parts, and all phone accessories. Free catalog by voice or fax: 732-840-1390 or www.heselectronics.com Get the full 44 page version by sending \$2 to HES Electronics, POB 183, Brick, NJ 08723. Mention this ad and get a \$10 certificate!

PHONE SYSTEMS WANTED!!! We buy AT&T MERLIN, SYSTEM 25/75/85 and other AT&T phone systems. Please call for a quote or fax us your equipment list. KEYWAYS, INC., 937-847-2300 or FAX 937-847-2350.

WHAT! YOU don't have TELECODE'S NEW 1998 "HACKERS CATALOG," yet! 125 + items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>

CALLER-ID PHONELINE simulator. Test/demonstrate telephone devices without phoneline! Six direct dial extensions, Caller-ID, distinctive ringing. Authentic dial tone, busy signals, 20Hz ringing. "Party-Line" kit includes PCB, all components, microprocessor, documentation, \$199.95. Custom enclosure \$32.95. Fully assembled \$425. Shipping \$8. Checks, credit cards. Digital Products Company, 134 Windstar Circle, Folsom, CA 95630. 916-985-7219, Fax 916-985-8460, E-Mail: digprod@aol.com Web site: www.digitalproductsco.com

COMPONENTS

DON LANCASTER'S ACTIVE FILTER COOKBOOK is back in print. Autographed copies of the seven-teenth(!) classic printing \$28.50. SYNERGETICS PRESS, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

ELECTRONIC COMPONENTS and kits. Catalog \$1. Dan's Small Parts and Kits, Box 3634, Missoula, MT 59806. Web: <http://www.fix.net/dans.html>

RF FERRITE and iron powder cores. Free catalog. Palomar Engineers, PO Box 46222, Escondido, CA 92046, 760-747-3343. Palomar@compuserve.com

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quicksand/goldtek.htm

OLD ICs & TRANSISTORS WANTED: HIGHEST PRICES PAID please FAX your list with part number, quantity & condition of any semiconductors to Rick @ ESI, 5363 Broadway Ave., Cleveland, OH 44127. 216-441-8500 FAX 216-441-8503. Since 1946! www.electronicssurplus.com

2539 W. 237th Street, Bldg. F, Torrance, CA 90505
 Order desk only: USA: (800) 872-8878 CA: (800) 223-9977
 L.A. & Technical Info: (310) 784-5488 Fax: (310) 784-7590
 OEM INQUIRIES WELCOME

TIMELINE INC.

Over 11 years and 29,000 customers and still growing

Minimum Order: \$20.00. Minimum shipping and handling charge \$5.00. We accept cashiers checks, MC or VISA. No personal checks or COD's. CA residents add 8.25% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign orders require special handling. Prices subject to change without notice. 20% restocking fee for returned orders.

LIQUID CRYSTAL DISPLAYS

240x64 dot LCD with built-in controller.
 AND 4021ST-EO. Unit is EL back-lit. \$59.⁰⁰ or 2 for \$109.⁰⁰ or
 OPTREX DMF5005 (non back-lit) \$49.⁰⁰ or 2 for \$89.⁰⁰
 20 character x 8 line The built-in controller allows you to do text and graphics.
 7/16" x 2 1/2"

Alphanumeric—parallel interface

16x1.....\$7.00	20x2.....\$10.00	32x2.....\$8.00
16x1 (lg. char.).....\$10.00	20x4.....\$15.00	40x1.....\$8.00
16x2.....\$7.00	20x4 (lg. char.).....\$10.00	40x2.....2 for \$20.00
16x2 (lg. char.).....\$10.00	24x2.....\$10.00	40x4.....\$20.00
16x4.....\$15.00	32x4.....\$10.00	4x2.....\$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • Certain models are backlit, call for more info.

Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	\$25.00	480x128	Hitachi	\$10.00
640x400 (backlit)	Panasonic	\$20.00	256x128	Epson	\$20.00
640x200	Toshiba	\$15.00	240x128 (backlit)	Optrex	\$20.00
480x128 (backlit)	ALPS	\$10.00	240x64	Epson	\$15.00
			160x128	Optrex	\$15.00

6" VGA LCD 640X480, Sanyo LMDK55-22 \$25.⁰⁰

MONITORS

9" COLOR SVGA MONITOR \$249.⁰⁰
 Fully Enclosed - Tilt and swivel type.

MONITORS

Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15KHz. • Ability to do 40 and 80 column.
5 inch Amber \$25.00 • 7 inch Amber \$25.00
9 inch Amber or Green \$25.00

5" COLOR MONITOR \$39.⁰⁰

• Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
 • 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
 • Open Frame Construction • Standard Interface Connector • Degaussing Coil included • Mfr. Samtron

2 for \$69.⁰⁰

HACKER CORNER

Encased Spread Spectrum RF Modem \$199.⁰⁰

The ProxLink Radio Module is a small communication device which replaces cables between RS-232 devices with wireless RF (Radio Frequency) technology. Attaching a pair of ProxLinks to any two devices with three wire asynchronous RS-232 ports allows wireless data transmission at rates up to 19.2 Kbaud (full duplex) over a range of 500 - 800 feet. Modules use 900 MZ spread spectrum radio for communication which does not require an FCC site license. A variety of configuration information (radio channel, baud rate, serial port configuration, etc.) can be programmed into module's non-volatile memory by host PC to provide compatibility and avoid overlapping systems. Configuration changes are supported by menu driven, on-board software. Commonly used Terminal Emulation software and transfer protocols can be used for configuring modules and transferring data between computers. ProxLinks require only 6-9 VDC (350 mA), RS-232 (9 pin sub-D) interface, and small (~4") whip antenna for operation. Unit size is 4.0" x 6.5" x 0.75". Installation schematics and application details available.

Encased Black & White Composite CCD Camera with Adapter

IR viewing to 1000 nm 7 1/2" L x 2 1/4" W x 1 1/4" H
 Comes complete with CCD camera, mounting nut on bottom of casing.
 12VDC power supply. Excellent low light capability, standard RCA NTSC video out. **\$89.00**
 Great for: entryway security/remote monitoring,
 video conferencing/desktop video conferencing **2 for \$159.00**

EMBEDDED 486 COMPUTER \$99.⁰⁰

Complete enhanced Intel 486SX-33 based computer in ultra small (9-7/8" x 6-5/8" x 3-1/8") case. Ideal for embedded operations or as a second computer. Features include: • One 16 bit ISA slot • 3 serial ports plus dedicated printer port • Parallel optical coupled adapter port • Built in IBM PC/AT keyboard port • On board VGA video and port • Uses standard SIMM up to 32 MB • BIOS is PC/AT compatible

Unit has a backup Ni-Cd battery system in case of power failure (5 min. backup time) and lockable front cover to prevent floppy drive access. Mounting / interface provisions for standard 3.5" laptop floppy and 2.5 inch hard drives. Comes with very comprehensive manual.

SONY Miniature Color LCD Display (LCX005BKB) \$29.⁰⁰

• 1.4 CM (0.55 inch) Diagonal Full Color Display • Built In Horizontal and Vertical Drivers • Delta Dot Pattern for High Picture Quality - 537 dots (H) x 222 dots (V) • Compatible with NTSC & PAL Format and Sync Inputs • 12 VDC Operation with -1 to +17 V RGB Signal and Driver Input Voltage • Excellent Display for Virtual Reality Projects, Viewfinders, and Miniature Test Equipment Displays • Pin Outs and Specification Included • Unit Requires Clock, Synchronization and Video

CELL SITE TRANSCEIVER \$49.⁰⁰ 2 for \$99.⁰⁰

These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 MHz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. Channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.990 MHz reference frequency for the digital synthesizer. The units contain independent boards for receivers, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

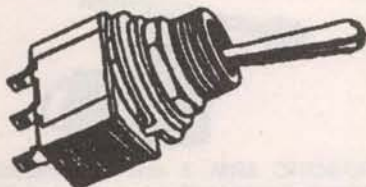
COLOR CCD CAMERA \$149.⁰⁰

• 12 VDC • 1/3-inch, CCD area image sensor • 514 (horizontal) x 491 (vertical) • 2:1 interlaced • 15.734 kHz (horizontal), 59.94 Hz (vertical) • 330 horizontal and 350 vertical lines • 10 lx • 1V, NTSC signal format • Lens: 1/3-inch, fixed focus (F:2.8 f5.6) • Dimensions: (W) 67 (2.63) x (H) 34 (1.45) x (D) 112.6 (4.43)

Write In 76 on Reader Service Card.

WANT TO Buy: ICs, military & aircraft relays, diodes, transistors, Cannon, TRW, Amp, Burndy, Deutsch, Bendix connectors, electronic test equipment & most components. Hoff Electronic Ent., 818-718-1165, FAX 818-341-5506.

COMPONENTS: MOTOROLA
 MC6802CP \$3, 74LS166AN 40¢, 74LS00B1 15¢, 74LS240 40¢, Z80 99¢, BOURNES 500 ohm \$1.75, 74LS164P 25¢, 74LS165AN 60¢. All parts unused, send check or money order to Lloyd's, 27315 Jefferson Ave. Ste. J-17, Temecula, CA 92590. \$4 for postage and handling.



AMAZING! 35¢ ALL TOGGLE SWITCHES. Brand new. Rated 6A/125V. Hardware included. 1/4" panel hole SPDT on-on, SPDT on-off-on, DPDT on-on, DPDT on-off-on. Minimum 100 pcs., no mixing. Add \$5 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864, Fax: 954-974-6818, VISA/MC. Free catalog.

VISIT OUR WEB SITE AT WWW.ALICABLE.COM

RESISTOR SPECIAL: 10,000 resistors 50 each of 200 values (our selection of values) 1/4 watt 1-5% metal and carbon film \$95 (less than 1¢ each). Or, you select the values and the quantity of each. Minimum of each value 50 pieces. Minimum order \$50. 5% 1¢ each 1-2% 2¢ each. Shipping and tax included. Each value clearly marked for ID. Over 400 values available from a stock of millions. You won't believe the time, money, and inconvenience you'll save. Hyatt Electronic Surplus, 371 N. Johnson Ave., El Cajon, CA 92020.

MICROCONTROLLERS

EPROM+ PROGRAMMER. Programs EPROMs, EEPROMs, NVRAMS, flash EPROMs, serial EEPROMs, BiPolar PROMs, PIC micros, microcontrollers and Motorola micros. \$250. 808-947-4864.

TSA6060, 89C2051, coils, chokes, caps, programming services. 1-888-664-8835.

COMPACT 68HC11 microcontroller 32K, RS232, LCD interface, compatible with interactive C, for your robotic and custom control applications. Bare PCB \$20, kit \$85 or assembled \$130. Embedded Acquisition Systems, <http://www.hooked.net/~jlong>

ATMEL 89CXXX programmer. IBM parallel port, C++ source code, schematics kit \$125. Assembled \$225. 808-949-5410 voice. 808-955-3959 fax.

ANTIQUE ELECTRONICS

WANTED: FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

CRYSTAL SETS. Parts, plans, books, kits. Largest source in the world. Catalog \$2. MIDCO, PO Box 2288, Hollywood, FL 33022.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

WESTERN ELECTRIC audio equipment wanted. 1926-1960s amplifiers, speakers, pre-amps, tube, transformers, etc. 1-800-old-mics 1-800-653-6427 Great Wireless Museum.

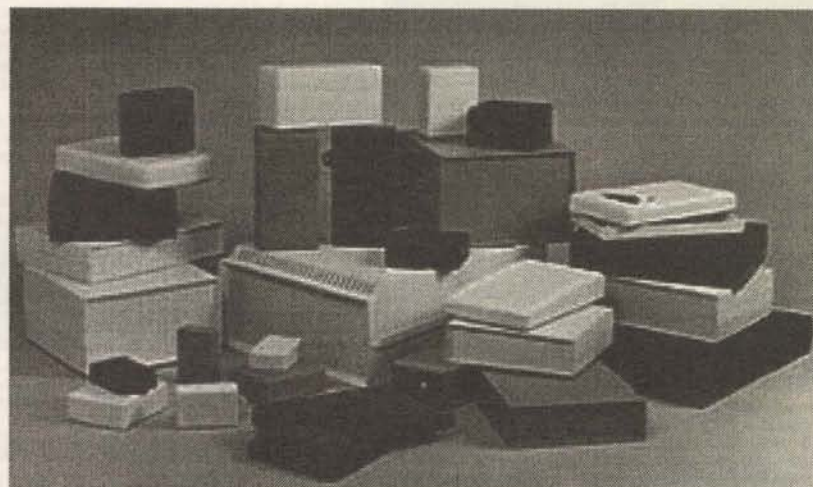
ANTIQUE RADIO CLASSIFIED. Free sample copy! Antique radio's largest-circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Subscribe today. Six-month trial: \$20.95. Yearly rates: \$40.95 (\$57.95 by 1st Class). Foreign: write. ARC, PO Box 802-G22, Carlisle, MA 01741. Phone: 978-371-0512; Fax: 978-371-7129; Web: www.antique-radio.com

WANTED: TOP CASH/REWARD FOR YOUR DBX Sub-Sonic synthesizer! Antique Video Transfer Service, 5001 Diamond Hts. Blvd., San Francisco, CA 94131-1621, 415-821-3359 fax 415-821-7500.

WESTERN ELECTRIC WANTED: 1920's-1960's. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.

Subscribe to Nuts & Volts Today!
 Call 1-800-783-4624
 and Use Your Visa or MasterCard.

"Let Us Cover Your Parts!"



- Eye-Catching Enclosures
- Exceptional Value
- Massive Inventory
- Custom Machining
- Quality Silkscreening
- EMI/RFI Shielding
- Over 50 Sizes

Call, Fax, or Visit On-Line for a
FREE Catalog
 email: simco@simcobox.com



SIMCO



(800) 780-9090 www.simcobox.com FAX (941) 452-6200

Write In 45 on Reader Service Card.

Nuts & Volts Magazine/June 1998 55

PUBLICATIONS

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

WHAT! YOU don't have **TELECODE'S** New 1998 "HACKERS CATALOG," yet! 125 + items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

ELECTRONIC EAVESDROPPING EQUIPMENT DESIGN by Winston Arrington. This revised edition contains 117 schematics and text of our production equipment. 29 crystal transmitters, 35 room, 32 telephone, 15 subcarrier, countermeasures and much more. Request a free detailed explanation sheet of contents. **PRICE:** \$65 + S&H \$6. **SHEFFIELD ELECTRONICS CO.,** PO Box 377940-E, Chicago, IL 60637-7940. Tel: 773-324-2196. <http://www.adnetmk.com/sheffield>

HACKER'S GOLD CD-ROMS (2) 30,000 programs! The most complete underground collection of hacker's files ever assembled. 550+ megabytes on each! Published: February 1998. Either CD-ROM \$34.95. Both \$49.95. 520-726-2833. **TELECODE,** PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscatalog.com/hackgold.htm>

TORMET'S ELECTRONICS BENCH REFERENCE. New reference book covering power supply design, transistors, logic, op-amps, SMDs, sources, and much more. See our web site for details at www.ohio.net/~tormet/index.htm or send check for \$19.95 + \$2.50 postage and handling to: RMT Engineering, 6863 Buffham Rd., Seville, OH 44273.

THE CASE AGAINST PATENTS. Don Lancaster's tested and proven alternatives that work in the real world. \$28.50. Synergetics Press, 3860 West First Street, Box 809, Thatcher, AZ 85552. 520-428-4073. synergetics@tinaja.com VISA/MC.

AMATEUR TELEVISION quarterly. \$18/year USA, \$20/year Canada, \$26/year overseas. 5931 Alma Dr., Rockford, IL 61108. 1-800-557-9469.

HOW TO CUT YOUR ELECTRIC BILL IN HALF - avoid high electric bills! You can reduce your bill by 50% using proven methods. Call **LORD/WYATT COMMUNICATIONS** for details 718-789-7329 press ext. 20.

Synthesized FM Stereo Transmitter

Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit.....\$129.95



Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit.....\$34.95

CFM, Matching Case and Antenna Set.....\$14.95

RF Power Booster Amplifier

Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit.....\$39.95

CLPA, Matching Case Set for LPA-1 Kit.....\$14.95

LPA-1WT, Fully Wired LPA-1 with Case.....\$99.95



Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to 108 MHz. 7/8" w x 3/8" h x 3/4" h.

FM-5 Micro FM Wireless Mike Kit.....\$19.95

Crystal Controlled Wireless Mike

Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condenser mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and loose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit.....\$39.95

FM-6WT Fully Wired FM-6.....\$69.95

RAMSEY Super Pro FM Stereo Radio Transmitter



A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or switching sounds from cheap CD player inputs!) Peak limiters for maximum "punch" in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes cabinet, whip antenna and 120 VAC supply. We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit.....\$299.95

FM-100WT, Fully Wired High Power FM-100.....\$429.95

AM Band Radio Transmitter



Ramsey AM radio transmitters operate in the standard AM broadcast band and are easily set to any clear channel in your area. Our AM-25, "pro" version, fully synthesized transmitter features easy frequency setting DIP switches for stable, no-drift frequency control, while being jumper settable for higher power output where regulations allow. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected range is up to 1/4 mile depending upon antenna and conditions. Transmitters accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case set and bottom loaded wire antenna. Our entry-level AM-1 has an available matching case and knob set for a finished, professional look.

AM-25 Professional AM Transmitter Kit.....\$129.95

AM-1 Entry level AM Radio Transmitter Kit.....\$29.95

Cam Matching Case Set for AM-1.....\$14.95

Tone-Grabber Touch Tone Decoder / Reader



Dialed phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit.....\$99.95

CTG, Matching Case Set for TG-1 Kit.....\$14.95

TG-1WT, Fully Wired Tone Grabber with Case.....\$149.95

AC12-5, 12 Volt DC Wall Plug Adapter.....\$9.95

The Cube World's Smallest TV Transmitter

Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color or B&W up to 150' to any TV tuned to cable channel 59 with a solid 20 mW of power. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Deluxe model includes sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Our cameras shown below have been tested to mate perfectly with The Cube and work great. Fully assembled.

C-2000 Video Transmitter Cube.....\$89.95

C-3000 Video and Audio Transmitter Cube.....\$149.95

CCD Camera Interface Board

Here's a nifty little kit that eases hook-up of your CCD camera module to any video monitor, VCR or video input TV set. The board provides a voltage regulated and filtered source to power the camera (CCD Cameras require a stable source of power for best operation), sensitive electret condenser mike for great sound pick-up and RCA Phono jacks for both audio and video outputs. Runs on 11 - 20 VDC

IB-1 Interface Board Kit.....\$14.95

CCD Video Cameras

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout'. These cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, these are super IR (Infrared) sensitive! Available with Wide-angle (80°) or super slim Pin-hole style lens. Both run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our Interface board (below) for Audio sound pick-up and direct wire connection to any Video monitor or TV video/audio input jacks. Fully assembled.

CCDWA-2 CCD Camera, wide-angle lens.....\$99.95

CCDPH-2 CCD Camera, slim fit pin-hole lens.....\$99.95

IR-1 IR Illuminator Kit.....\$24.95

Call for our Free Catalog !

RAMSEY ELECTRONICS, INC.
793 Canning Parkway
Victor, NY 14564

Order Toll-free: 1-800-446-2295

Sorry, no tech info or order status at this number

Technical Info, Order Status
Call Factory direct: (716) 924-4560

www.ramseyelectronics.com



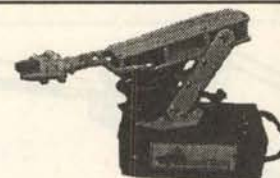
ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add \$6.95 for shipping, handling and insurance. Orders under \$20, add \$3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

ROBOTICS

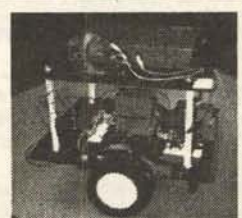
MECHANICAL ASSEMBLIES, bearings, electronics, motors, aluminum, brass, bronze, stainless, titanium, optics, jewels, books, etc. Salvage and new. Send self-addressed legal size envelope for list to: RoboParts, 15722 Ashland Drive, Laurel, MD 20707. Wish lists and your parts to: RoboParts@aol.com



HEXAPOD ROBOT, walks forward, reverse turns left and right. Comes with everything to build your own robot. Includes a counterfeit Basic Stamp with example code. \$150 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard. Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots



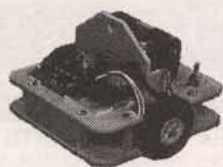
ROBOTIC ARM, 5 axis arm, including gripper. Control with any serial port. Very accurate and repeatable. Comes with everything to build your own robot. Includes a MiniSSC2 servo controller with software. \$195 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard. Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.



ZAGROS ROBOTICS mobile robotic kits and parts. Artificial intelligence software, sonar units and much more. PO Box 460342, St. Louis, MO 63146-7342. 314-768-1328, E-Mail: info@zagrosrobotics.com web page: <http://www.zagrosrobotics.com>

H-BRIDGE MOTOR controllers, 12VDC, 35A average, 50A peak PWM out. Forward, reverse, ramp-up and ramp-down on acceleration/deceleration. Current foldback when hot, reverse polarity protected, conformal coated, regenerative braking, compact, approx. 3.75"x5.5". \$25 & S&H. 717-735-5053. <http://members.tripod.com/~divelec>

LOW-COST CNC write: motivity, Attn. Pam, PO Box 428, Rocklin, CA 95677. Call 916-349-8757. Info/pictures at www.motivityusa.com A great place to buy CNC.



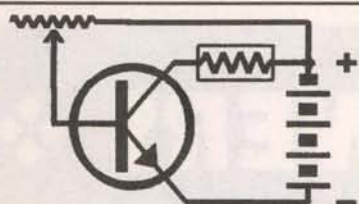
MICROMOUSE ROBOT, can be used for line tracking, mazes, etc. Everything you need to build your own robot. Includes a Counterfeit Basic Stamp with example code. \$95 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard, Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.



MOBILE ARM, 5 axis arm including gripper plus mobile base. Control with PC or microcontroller. Everything you need to build your own robot. Includes a MiniSSC2 servo controller with software. \$250 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard, Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.

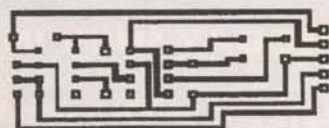
PLANS — KITS — SCHEMATICS

HOBBY CATALOG: Broadcasting and microbroadcasting transmitters, amplifiers, antennas. **Start your own radio station books.** Audio, TV, ham, CB, surveillance, science projects, and more. **PAN-COM International**, Box 130-V, Paradise, CA 95967. www.panaxis.com



TRANSISTOR THEORY SIMPLIFIED. A new, easier to understand approach. Other basic electronics theory included. Lots of useful information. 22 page text \$6.45 ppd. Credit card orders 703-549-5325 or mail check to: **THERMADYNE, INC.**, 206 Birch St., Alexandria, VA 22305. Details on our web page: WWW.pacificocean.com/thermadyne

PHONELINE SIMULATOR. Authentic dial tone, busy signals, 20Hz ringing. Test/demonstrate phones, modems, faxes, voice mail, etc. "Ring-It" kit includes PCB, all components, microprocessor, documentation, \$149. Custom enclosure \$34.95. Fully assembled \$325. Shipping \$6.50. Checks, credit cards. Digital Products Company, 134 Windstar Circle, Folsom, CA 95630. 916-985-7219, Fax 916-985-8460, E-Mail: digprod@aol.com Web site: www.digitalproductsco.com



CIRCUIT BOARDS. Single sided. No minimum. No set-up fees. No hidden costs. No per hole charge, up to 1,000 holes per panel. Complete price list available. Circuit Design, PO Box 5415, Central Point, OR 97502, 541-664-7904. Phone or Fax: <http://www.cdsnet.net/Business/circuits/>

TEST EQUIPMENT kits. If you liked Heathkit, you will love Technology Systems, 4 Prospect Pl., Torrington, CT 06790.

200+ ELECTRONIC PROJECTS. Build for pleasure or make 100% (or more) profits reselling printed plans. Loose 55¢ stamp for catalog & dealer info. MATCO-A4, POB 509, ROSEVILLE, MI 48066-0509.

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET.

ELECTRONIC KITS, projects and supplies for prototyping, designing or hobby. Call 1-888-GO-4-KITS for catalogs or send \$3 to Quality Kits, 49 McMichael St., Kingston, ON., K7M 1M8. <http://www.qkits.com>



BROADCAST FARTHER! 75-110MHz amplifier connects to stereo transmitters. Produces 2-15 watts. Requires 50-150mW drive. Complete plans with part source and antenna information only \$14 + \$2 S&H. **Progressive Concepts**, PO Box 586, Streamwood, IL 60107. 630-736-9822.

SHORTCUT PROJECT CONSTRUCTION TIMES with quickest protoboards available, 18-40 pin PIC/other CPUs supported. Also, PIC monitor and RS-232 instrumentation chips/kits, pocket test-bench kit. **Oricom Technologies**, 303-444-9776 (www.sni.net/~oricom).

BUILD THE MENDOCINO MOTOR. This fascinating device is a solar powered, magnetically levitated motor. It will delight and amaze you and your friends. The 27 page plans book includes a list of parts suppliers. The motor uses readily available parts. Plans are \$15 plus \$2.50 S&H. Write to: St. Elmo's Fire, PO Box 141, Stow, MA 01775. E-Mail: tcv@genrad.com

24 Hr. Shipping

To Order Call 1-800-292-7711 Fax: (847) 541-9904

Quality Kits for Hobbyist and Students

All Kits include PCB, all parts, and detailed assembly manuals.

XK-700 Digital / Analog Trainer

Elenco's newest advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular and square wave forms. 1560 tie point breadboard area. Tools and meter shown optional (Mounted in a professional tool case made of reinforced metal).

XK-700
Assembled and Tested
\$189.95

XK-700-SEMI KIT
w/ Fully Assembled PC Board
\$174.95

XK-700K - Kit
\$159.95



Made in the USA

Hobbyist Tool Kit TK-1000

All the tools you'll need to build these kits. 25 tools contained in a heavy-duty carrying case.

\$39.95



Stereo Cassette Player Kit \$14.95 AK-200

- Transparent Case
- Belt Clip
- High Resolution
- Includes Head-phones



M-1005K Digital Multimeter Kit

Low cost, 3 1/2 digit LCD, 18 ranges, transistor test, diode test, overload protection and pocket-size.

\$19.95



AM/FM-108K

AM/FM Radio Kit and Training Course 14 Transistors and 5 Diodes

\$29.95



AM Radio Kit and Training Course 7 Transistors and 1 Diode **\$19.95**

FO-30K

Fiber Optics Technology with Training Course **\$24.95**
Learn the basics of fiber optics data communications while you build this exciting kit. Comes complete with all necessary components.



Telephone Kit Model AK-700

Build this high-tech see-thru plastic telephone. Learn theory on how telephones work and then proudly show off your work with the transparent phone case. Complete with all parts and manual. Neon lamps flash when the phone rings.



\$15.95

AR-2N6K

2 meter / 6 meter Amateur Radio Kit



\$34.95

AK-300 Digital Roulette Kit

This Digital Roulette Kit is just like the real thing. With a push of a button, the LEDs spin round and round. Where they stop is anybody's guess. It's unique design includes "pop out" chips of different values. Enjoy hours of fun with this game of chance. Requires one (1) 9V battery.



\$14.95

Elenco XP-720K Power Supply Kit

3 fully regulated stackable DC supplies.
+1.5VDC to 15VDC @ 1A
-1.5VDC to 15VDC @ 1A
+5VDC @ 3A
Plus 2 AC supplies:
6.3VAC @ 1A
12.6VAC @ 1A



\$54.95

Sound Activated Switch Model K-35

Clap and the light comes on, clap again and it goes off.



Telephone Bug Model K-35

Size of a dime, yet transmits both sides of a phone conversation to any FM radio. No battery needed.



\$7.95

Strobe Light Kit Model AK-520

You will have fun building this kit and learn how strobe lights work. Complete with all parts and case. **\$54.95**



Motion Detector Kit Model AK-510

Simple and fun to build. Compact, portable, and adds safety to your home or office. Requires one (1) 9V battery.



\$14.95

Guaranteed Lowest Prices

UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8.25% Sales Tax

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 541-9904 • (847) 541-0710
http://www.elenco.com/cs_sales

15 DAY MONEY BACK GUARANTEE FULL FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Metric
Equipment Sales, Inc.

800-432-3424
Fax: 510-264-0886
www.metricsales.com



Scopes, Meters, Analyzers, Power Supplies, Signal
Generators, Counters, Recorders and more

Hewlett-Packard, Tektronix, Fluke, Dranetz, TTC, Anritsu,
Wavetek, Keithley, and more

Test & Measurement Instruments

Over 7000 Models • 6-Month Warranty
Save 30-90% • 5-Day Free Trial

Write in 42 on Reader Service Card.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

MOD CHIPS for Sony PlayStation. Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. www.cconusa.com

PC BOARDS single-sided. Price list available. 808-949-5410 voice. 808-955-3959 fax.

DATA ACQUISITION 12 bit, bipolar, eight channel analog to digital converter module with I/O for your PC parallel port. Bare PCB \$15, kit \$65 or assembled \$85. Embedded Acquisition Systems, http://www.hooked.net/~jifong

SURVEILLANCE TRANSMITTER SCHEMATICS! FM band- 2 telephone and 3 room transmitters constructed using Radio Shack parts with their numbers given. One telephone and two room transmitters are tunable from 65 to 305MHz, and constructed with listed supply house parts. PC board patterns presented. **PRICE:** \$25 + S&H \$2. For immediate shipment, pay with money order. **SHEFFIELD ELECTRONICS CO.**, PO Box 377940-E, Chicago, IL 60637-7940. Tel: 773-324-2196. http://www.adnetmk.com/sheffield

UNLIMITED UNDERGROUND ELECTRONICS. Electronic weapons, EMP, rail guns, plans, kits, parts, alt energy, more. **SASE** for free catalog or http://www.access1.net/nintech & visit http://www.info-labs.com UUE: 1839-D West Vistaway #515, Vista, CA 92083

Sell Nuts & Volts
in your store and earn \$\$\$!
Contact us for details. 909-371-8497
E-Mail distributors@nutsvolts.com

**MANUALS —
SCHEMATICS WANTED**

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

**MISCELLANEOUS
ELECTRONICS FOR SALE**

FREE FLYER on cable TV, phones, credit cards info, schematics, project boards, other misc. items. Bill 1-800-879-9657.



SOLAR-POWERED FAN HAT. Baseball type hat with solar powered fan. Great for sports fans, golfers, etc. Available in red or blue. \$19 plus \$2.00 shipping. CA residents add 7.75% sales tax. Visa/MC/Disc/Amex OK. H.T. Orr Computer Supplies, 249 Juanita Way, Placentia, CA 92670. 714-528-9822, 1-800-377-2023, FAX 714-993-6216.

RF FERRITE and iron powder cores. Free catalog. Palomar Engineers, PO Box 462222, Escondido, CA 92046, 760-747-3343. Palomar@compuserve.com

ELECTRON TUBES: All types bought and sold. Daily Electronics, B-6 10914 NE 39th St., Vancouver, WA 98682. 1-800-346-6667, 360-896-5476 FAX.

❖ ATTENTION CABLE VIEWERS ❖

CABLE VIEWERS . . . get back to your BASIC Cable Needs

Call 1-800-577-8775

For information regarding all of your **BASIC** cable needs.

5 GOOD REASONS TO BUY OUR FAR SUPERIOR PRODUCT

- ❖ **PRICE**
- ❖ **EFFICIENT SALES AND SERVICE**
- ❖ **WE SPECIALIZE IN 5, 10 LOT PRICING**
- ❖ **ALL FUNCTIONS (COMPATIBLE WITH ALL MAJOR BRANDS)**
- ❖ **ANY SIZE ORDER FILLED WITH SAME DAY SHIPPING**

We handle **NEW** equipment **ONLY** — Don't trust last years **OBSOLETE** and **UNSOLD** stock!
COMPETITIVE PRICING — DEALERS WELCOME

It is not the intent of B.E.S.W. to defraud any pay television operator and we will not assist any company or individual in doing the same.
*Refer to sales personnel for specifications.

P.O. BOX 8180 • BARTLETT, IL 60103-8180 • 847-584-2099



**BASIC
ELECTRICAL
SUPPLY &
WAREHOUSING
CORPORATION**

HIGH QUALITY TOOLS AND STAINLESS STEEL HARDWARE. European and American screwdrivers, nut-drivers, pliers, hex- keys, balldrivers, and more! Wiha, Bondhus, and Knipex. Stainless cap screws, machine screws, nuts, washers, U-bolts, and eyes. Free catalog. Robert Mink Import-Export, Box 6437V, Fair Haven, NJ 07704. Telephone or fax 732-758-8388. E-Mail: w2tv@csi.com

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

RADAR GUNS: MPH Industries, model K-55. Displays your speed & target speed. Comes w/case & instructions. Only \$300. 1-800-539-2859.



ANAHEIM WIRE PRODUCTS. DISTRIBUTOR OF ELECTRICAL WIRE AND CABLE since 1973. Items available from our stock: Hook up wire, Automotive primary wire, GXL, SXL, Plenum cable, Teflon wire, Multi-conductor cable, Irradiated PVC, SO-CORD, Mil-Spec wire, Building wire, Welding cable, Battery cable, Telephone wire, Shrink tubing, Cable ties, Connectors. If interested, please call 1-800-626-7540, FAX: 714-771-5043. Visa/MC/Amex. SEE US ON THE INTERNET: <http://www.anaheimwire.com> OR E-Mail: info@anaheimwire.com

ELECTRONIC ASSEMBLY MACHINERY. We buy and sell assembly machinery including solder machines and board cleaners, insertion machines and lead formers. Petlock Inc., Rialto, CA. 909-877-8900, FAX 909-877-8902.

NEW, USED, and "as is" Radio Shack items. Software, printers, computers, books, parts for R/C cars, etc. Free list. B and B Enterprises, 208 S. Pulaski St., Baltimore, MD 21223. 410-566-5388.

NUCLEAR ELECTRONICS (NIM, CAMAC), PMTs, optics, high vacuum, and high voltage components and equipment. Guaranteed quality at reasonable cost. OE Technologies, Box 703, La Madera, NM 87539. Ph: 505-583-2482, Fax: 505-583-9190, E-Mail: oetech@newmexico.com <http://www.oetech.com>



EMPLOYEE/NANNY SURVEILLANCE: Undetectable wireless audio/video camera in clock/radio. **ABSOLUTELY THE LOWEST PRICE!** Other products available! CALL 1-800-813-0007 **SURVEILLANCE SPECIALISTS.**

ELECTRONIC PARTS - LOW PRICES! Phone, fax, E-Mail for free catalog. Hoffman Industries, 853 Dundee Ave., Elgin, IL 60120, Ph: 847-622-8201, Fax: 847-622-8202, Toll free: 1-888-311-4248, E-Mail: hoffmanind@worldnet.att.net Visit our Web Site & browse our On Line catalog: www.hoffind.com

DC MOTOR 3/4 HP 1750 RPM 56C with 120/240VAC thyristor speed control, new \$125, Sola constant voltage transformer 2,000VA multi-volt input \$150, metal halide ballast kit 1,000W multi-volt input \$22, Pabst type 4182NX cooling fan, 4-1/2" metal frame 12VDC-3/8A \$2.50 ea. Dave Maley 816-231-2029. Leave message, will return all calls.

TSA6060, 89C2051, coils, chokes, caps, programming services. 1-888-664-8835.

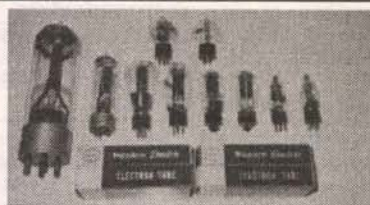
SOLAR PANELS, old radios, transmitter & high voltage parts, tubes, 60's stuff and more. Automatic markdown! Picture, on-line catalog: www.Nmart.com

SATELLITE SAM'S inventory liquidation: 2000 low profile transformers dual output 14 & 42 VAC; saw filters; 24V DC motors w/gear boxes; opto-interruptors OPB-1819; transistors; capacitors; Draco power supplies. Call 1-800-424-1228 or fax 765-289-9403. Sun Distributing of IN.

MISCELLANEOUS ELECTRONICS WANTED

WANTED: BALANCING machines & vibration analyzing equipment manufactured by the following: Spectral Dynamics, Hofmann, Bentley Nevada, Schenck, IRD Mechanalysis, Gishott. Contact Mike Park at E.T. Balancing, 12823 Athens Way, Los Angeles, CA 90061. 310-538-9738, FAX: 310-538-8273.

TESTERS WANTED: Immediate offers made for Ultrasonic, Magnetic Particle, Eddy Current, X-Ray and Borescopes, 24hrs. Leave detailed message with make/model. 1-800-530-3371.



HIGHEST PRICES paid for Western Electric tubes, new and used. Call Don Singerhouse/Singerhouse Sound. Toll free 1-888-715-tube.

WANTED: ELECTRICAL materials, Allen-Bradley, Agastat, Appleton, Crouse-hinds, T&B, Square D, Pyle National, Russel & Stoll, circuit breakers, fuses, connectors. Call Beiner Sales, 805-376-9044, FAX 805-376-8207.

EXCESS INVENTORY WANTED: Transistors, semiconductors, capacitors, PC boards, & diodes. We buy it all!! Contact: SEMITECH, INC., 381 Roberts Road, Oldsmar, FL 34677. Phone 813-854-3311, FAX 813-854-3422.

MIDWEST ELECTRONICS

124 12TH AVE. SOUTH, MINNEAPOLIS, MN 55415
PHONE: (612) 339-9533 FAX: (612) 305-0964
WWW.MIDWEST-ELECTRONICS.COM

WE NOW HAVE **ZENITH PENTIUM COMPUTERS**
100, 120, 133, 166 MHZ MULTIMEDIA & BUSINESS SYSTEMS
MANY CONFIGURATIONS STARTING AT **\$375 W/O MONITOR**

ALTEC LANSING ACS45W SPEAKERS \$49
POWERED SUBWOOFER & STEREO SATELLITE MODULES
MANY OTHER PREMIUM SPEAKERS AT LIQUIDATION PRICES

WINDOWS 95 MULTIMEDIA KEYBOARDS — CONTROL CD-ROM,
VOLUME, MUTE, INTERNET ACCESS, MODEM FROM
KEYBOARD, INCLUDES DRIVERS — **\$15**

HARD DRIVES:
840MB - \$99, 2.1GB - \$169, 2.5GB - \$179, 4.3GB - \$209
IBM 2-1/2" 172MB - \$25

**CALL FOR CURRENT INFORMATION ON OUR
HARD DRIVE, CPU, AND MEMORY INVENTORY**

NEW MONITORS

15" 1024X768 SVGA .28DP \$219
17" 1280X1024 SVGA .28DP \$399

VIDEO

2MB PCI VIDEO CARD \$45

MODEMS

33.6 INT. DATA/FAX
MODEM W/VOICE \$49
56K FLEX MODEM FOR PENTIUM \$65

MULTIMEDIA

24X IDE CD-ROM \$74
16 BIT STEREO SOUND CARD \$19

BRAND NEW ACER 101 KEYBOARDS \$8 CLEAN USED PS/2 KEY-
BOARDS \$5 NEW MINI-TOWER CASES W/250 WATT POWER
SUPPLY \$34 PS-2 MOUSE \$15

SERIAL MOUSE \$10 1.44 FLOPPY DISK DRIVE \$19

QUANTITY DISCOUNTS AVAILABLE ON ALL ITEMS

**CALL US OR CHECK OUR WEB PAGE FOR GREAT DEALS ON
NEW AND USED COMPUTERS, PARTS & ACCESSORIES**

Write in 119 on Reader Service Card.

AMAZING PRODUCTS! BOX 716 AMHERST, N.H. 03031

INFORMATION VISIT OUR "ACTION" WEB SITE@
UNLIMITED DEPT NV 0498 <http://www.amazing1.com>

LASER WINDOW BOUNCE OPTICAL RECEIVER

Operates With Our Laser Pointers
And HeNe Gas Systems

High Sensitivity Optical Receiver with built in speech filter and low noise light biased pre-amplifier. Include cushioned headsets with separate volume controls and all instructions to demonstrate and utilize this remarkable property of laser light.

LLR3 Plans...\$10.00 LLR3K Kit/Plans...\$69.50
LLR30 Ready to Use...\$99.50
EXT10 Optional Range Extension Lens...\$39.50

Uses Scattered and Direct Reflections



ULTRA BRIGHT LASERS

1 Year Warranty
Batteries Included
All Metal Enclosure

LAPN65 Versatile...15mw equiv 2000 ft...\$29.95
LAPN65F Focusable Model of Above...\$34.95
LAPN63 Brightest...30mw equiv 3000 ft...\$69.95
LAPN63F Focusable Model of Above...\$74.95
CREATE YOUR OWN LIGHT SHOW!!!
LAPN65PT Laser Multi Pattern Generator...\$29.95
LAPN65M Mini Key Chain All Metal...\$39.95
LAPN67...5mw @ 670nm LOWEST COST...\$19.95

WIRELESS LAB KITS

ALL PARTS TO BUILD 6 EXCITING
TRANSMITTER PROJECTS

- 1 Super Sensitive Ultra Clear 1 Mile + Voice Transmitter
 - 2 1 Mile + Telephone Transmitter
 - 3 Line Powered Telephone Transmitter Never Needs Batteries!
 - 4 Tracking/Homing Beacon "Beeping Transmitter"
 - 5 Transmitter Rebroadcasts Video or Audio Outputs
 - 6 Short Range TV/FM Disrupter NEAT PRANK!! Discretion Advised
- All 6 Above Kits Plus FREE Info Data Pack on "HELPFUL HINTS" Building and Tuning Wireless Devices
COMBOX Parts and Plans for above...\$59.50
COMBOP Plans for all the above!...\$10.00

KINETIC ELECTRIC GUN

PIONEER A FUTURISTIC WEAPON!

500 Joules Energy Storage
Constant Current Charging
Triggered Spark Switch
Ballistic Velocities
Handheld Battery Operated
Labeled A Dangers product

EGUN1 Plans with Parts List...\$20.00
All Parts are Individually Available

3 MI FM BROADCAST TELEPHONE TRANSMITTER

Tunable On FM Broadcast. Excellent Telephone Project. Only Transmits When Phone is Used
VWPM7K Kit/Plans...\$39.50
BEEP1K Beeper Alert Kit...\$19.95

10-14" of Explosive Bolts of Lightning

250KV TESLA COIL
Transmit Wireless Energy
Strange and Bizarre
pyrotechnical effects.
Ion Motors Anti-Gravity
Size 20" H x 8" Sq
Weight - 25 Pounds
115 Volts/2 Amps AC
Labeled "Use Caution"

BTC3 Plans...\$15.00
BTC3K Kit/Plans...\$399.50
BTC30 Ready to Use...\$499.50
BTC4 Plans 24 to 30" Sprk...\$20.00

HIGH POWER STUNGUNS

STUN100 100KV StunGun...\$29.50
STUN200 200KV StunGun...\$49.50
STUN300 300KV StunGun...\$69.50

ION RAY GUN

PROJECTS ENERGY!

Star Wars Technology Demonstrates
Weapons Potential! See Ions in Motion!
IOG7/9 Plans...\$10.00
IOG7K Kit/Plans...\$99.50

HIGHER POWERED DEVICE

IOG9K Kit/Plans...\$149.50

ATTENTION!

High Voltage Experimenters
Battery Powered Mini Sized
Modules for research in:
HOVERCRAFT, ION GUNS
FORCE FIELDS, SHOCKERS etc
MINIMAX4 4KV@10ma...\$19.50

GRAVITY GENERATOR

Demonstrates a unique
phenomena of electrical
reactions that produce the
effect of "anti-gravity". You
build and levitate a small
mock space ship from simple
materials. Excellent scientific
demonstration of a
fascinating method of
levitation. **Levitate an Object!**

GRA1 Plans and Book...\$20.00
GRA1K Pwr Sup Kit/Plans...\$99.50
GRA10 Assembled Pwr Sup...\$149.50

SHOCK FORCE FIELD/VEHICLE OBJECT ELECTRIFIER

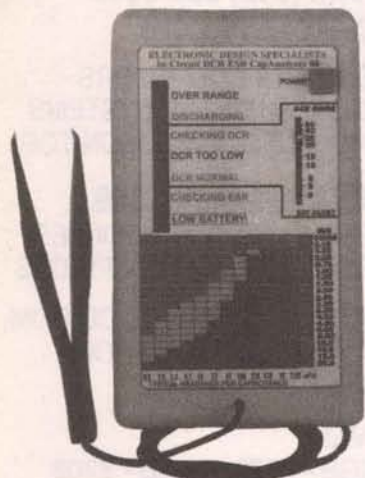
Hand Shock Balls,
Wands, Electrify
Objects, Great Payback
for Those Who Steal!
CAUTION
Monstrous
is illegal!
SHK1K Kit of Pwr Module...\$19.50

1 800 221 1705 ORDERS ONLY! FAX 1 603 672 5406 INFO 9-5pm 1 603 673 4730 FREE CATALOG ON REQUEST
Pay by MC, VISA, Cash, Chk, MO, COD. Please Add \$5.00 S&H plus \$5.00 if COD. Overseas Please Contact for PROFORMA

Write in 202 on Reader Service Card.

Nuts & Volts Magazine/June 1998 59

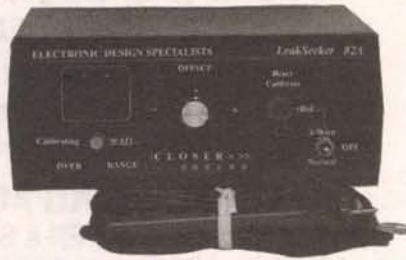
CHECK CAPACITORS IN-CIRCUIT WITH 100% ACCURACY



CapAnalyzer 88 \$179

- Automatically discharges cap; Checks for low DCR and shorts; Checks high-frequency ESR and displays on 20-segment LED meter
- 3-color chart shows typical values.
- Includes gold-plated tweezer probe
- Portable... Batteries included!

LOCATE ANY SHORTED or LEAKY COMPONENT TO THE EXACT SPOT



LeakSeeker 82A \$179

Locates shorted & leaky parts to the exact spot on the PCB without cutting up the board or unsoldering any parts!

• 60 DAY MONEY-BACK GUARANTEE ON ALL EDS TEST EQUIPMENT

• AVAILABLE AT YOUR FAVORITE DISTRIBUTOR

SEE US AT NESDA CONVENTION
IN ORLANDO, FL AUGUST 12, 13

ELECTRONIC DESIGN SPECIALISTS

4647 Appalachian St, Boca Raton, FL 33428 561-487-6103 www.eds-inc.com



we make test equipment designed to make you money.

Write in 120 on Reader Service Card.

Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

Features

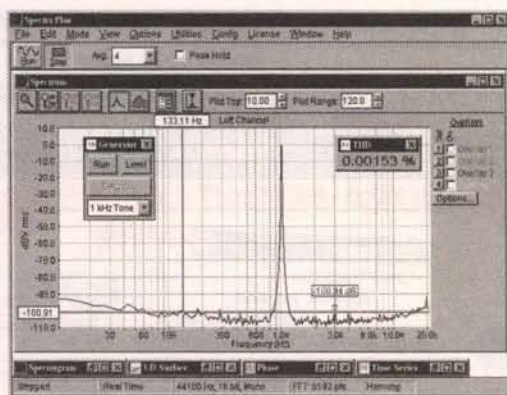
- 20 kHz real-time bandwidth
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- THD, THD+N, SNR measurements
- Signal Generation
- Digital Filtering
- Triggering, Decimation
- Transfer Functions, Coherence
- Dynamic Data Exchange (DDE)
- Time Series, Spectrum Phase, Spectrogram and 3-D Surface plots
- Real-Time Recording and Post-Processing modes

Applications

- Distortion Analysis
- Frequency Response Testing
- Vibration Measurements
- Acoustic Research

System Requirements

- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor
- 16 bit sound card



Priced from \$299

(U.S. sales only - not for export/resale)

Professional Quality Sound Cards Available...Call

DOWNLOAD FREE 30 DAY TRIAL!

www.telebyte.com/pioneer

PHS

Pioneer Hill Software
24460 Mason Rd. N.W.
Poulsbo, WA 98370

Spectra Plus 4.0

Affordable Signal Processing Software

Sales: (360) 697-3472

Fax: (360) 697-7717

e-mail: pioneer@telebyte.com

WANTED: ELECTRON tubes, ICs, semi-conductors. Astral, PO Box 707NV, Linden, NJ 07036. Call 1-800-666-8467.

WANTED: TUBE HiFi/commercial amps, preamps, corner/horn speakers. Altec, Marantz, McIntosh, Western Electric, etc. 405-737-3312 fax 405-737-3355.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

WESTERN ELECTRIC audio equipment wanted. 1926-1960s amplifiers, speakers, pre-amps, tube, transformers, etc. 1-800-old-mics 1-800-653-6427 Great Wireless Museum.

WANTED: ELECTRONIC estates. Ham, broadcasting, military, test, public address, tubes, transformers, telex equipment. The bigger the pile, the more worthwhile. We fly anywhere. Sumner McDanel 1-800-251-5454.

RADAR/MICROWAVE equip: Aviation, marine, fire control. Like TPS 21, APS 10, 42 APG 30. Parts, TM's, etc. Radar, Box 10215, Pittsburgh, PA 15232.

OLD ICs & TRANSISTORS WANTED: HIGHEST PRICES PAID please FAX your list with part number, quantity & condition of any semiconductors to Rick @ ESI, 5363 Broadway Ave., Cleveland, OH 44127. 216-441-8500 FAX 216-441-8503. Since 1946! www.electronic surplus.com

WANTED: TUBES, radios, transmitters, receivers, gyros, bearings, connectors, relays, lamps, synchros. Hyness Company, 709B Delair Road, Cranbury, NJ 08512-4212. Phone: 609-395-1116, FAX 609-395-1117.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

WE BUY your electronic excess inventories. ICs, caps, transistors, LED, connectors, PCBs, computers and related products. Call Tom Freeman 714-558-8813, fax 714-558-1603.

WANTED PIONEER 5XXX-6XXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

WESTERN ELECTRIC WANTED: 1920's-1960's. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.

ELECTRON TUBES, transistors-RF aircraft radar & comm. Sold or bought. ARS Electronics, 7110 De Celis Pl., Van Nuys, CA 91406. 1-800-422-4250, fax 818-997-6158.

WANTED: SURPLUS electron tubes, Allen-Bradley carbon comp. resistors, Sprague Black Beauty caps. Contact Charlie 626-444-7079, Fax 626-444-6863.

BBS & ONLINE SERVICES

VISIT DON Lancaster's GURU'S LAIR website at <http://www.tinaja.com> PICs, pseudoscience, PostScript, patents, Tinaja quests, flutterwumpers, book-on-demand, magic sinewaves, money machines, Navicubes, tramways, wavelets, and Webmastering. Online reprints, consultants net, forums, annotated hot links, surplus bargains, great heaping bunches more.

VISIT OUR WEB SITE AT WWW.ALLCABLE.COM

MOD CHIPS for Sony PlayStation. Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. www.cconusa.com

EDUCATION

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

DON LANCASTER'S ACTIVE FILTER COOKBOOK is back in print. Autographed copies of the seventeenth(!) classic printing \$28.50. **SYNERGETICS PRESS,** Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

BUSINESS OPPORTUNITIES

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

THE CASE AGAINST PATENTS. Thoroughly tested and proven alternatives that work in the real world, \$28.50. **SYNERGETICS PRESS,** Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quiksand/goldtek.htm

IDEAS = CASH: New techniques to speed your product to market at a very reasonable cost. GEKCO Labs, PO Box 642, Issaquah, WA 98027-6730, 425-392-0638. E-Mail: ideas@gekco.com

HOME AUTOMATION DEALERS WANTED. Free information. Call 1-800-838-4051 or fax name, address, and telephone to 402-729-3863.

POSITION AVAILABLE: mid-sized electronic component manufacturer (Northeast coast of Florida) is seeking an innovative, creative person with a mechanical or electrical engineering background to develop mechanized/automated production lines. If you enjoy the projects and concepts of this publication (Nuts & Volts), then you are the person we are seeking. Excellent salary for the right individual. Send resume by fax 904-445-6871, E-Mail: rmsamrad@pcfi.net or contact Ms. Sandra DeFalco, American Radionic Co., Inc. at 904-445-6000, Palm Coast, FL.

WHAT! YOU don't have **TELECODE'S NEW 1998 "HACKERS CATALOG,"** yet! 125 + items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>

INTERNET-BASED Electronics business for sale. Run as full/part-time. 15 years established customer base. Write for particulars. Principles or agents okay. JLR, PO Box 744186, Dallas, TX 75374.

**Closing Date
For Next Issue - June 5th**

AVIATION ELECTRONICS

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

REPAIRS — SERVICES

ENGINEERING CONSULTING. Product development from conceptual to manufacturing stages. Digital, analog, and RF expertise. Microcontroller designs for HC05xx, HC11xx, PIC16C5x. Software design for IBM PC. ASIC design using XILINX. In-house schematic capture and PWB. Steve Hicks, DiaSystems Electronics, 7508 E. Granada Rd., Scottsdale, AZ 85257. 602-970-3162. E-Mail: diasys@cyberhighway.net website: www.cyberhighway.net/~diasys

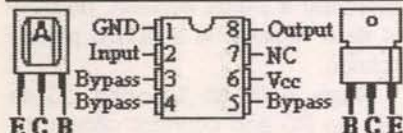
PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

PINBALL MACHINES! Books, Magazines, Manuals, Diagrams, Supplies, Parts. \$2 catalog, Marco Specialties, 5290-N Platt Springs Rd., Lexington, SC 29073-9252. 803-957-5500. FAX 803-957-6974. E-Mail: tilt@ix.netcom.com http://www.pinballusa.com

(E)EPROM PROGRAMMING done quickly and economically. One day turn around typical. Simple copy \$3 per device. Also prototyping, design, and consulting services available. Call or send SASE to: Luzer Electronics, 4023 North Bayberry, Wichita, KS 67226. 316-687-2127, FAX 316-687-3103.

WELD ALUMINUM WITH PROPANE! EZ, INEXPENSIVE, STRONG. DETAILS: WEEKS, 36 CAROLINA ST., TAYLORS, SC 29687. 1-800-547-WELD(9353) FAX 864-244-6349. http://www.dura-fix.com

20,000 + TECHNICAL REPAIRS for TVs, VCRs, PROJECTION TVs, CAMCORDERS, AUDIO on disk. COMPONENT/BOARD LEVEL REPAIRS. Installs on your hard drive. Easy look-up by model/chassis number. ADD your own repairs. PRINT out repairs. Special Sale only \$125. Send this ad with check. Call or write for FREE sample program with over 300 repairs. HIGHER INTELLIGENCE SOFTWARE, 60 FARMINGTON LANE, MELVILLE, NY 11747. 1-800-215-5081.



SEMICONDUCTOR CROSS-REFERENCE LIBRARY (SCRL) software for the PC. 378,000+ devices, with descriptions, and case drawings for most. \$69 plus \$6 S&H. **ELECTRONIC REPAIR TIPS**, 46,000+ original up to date tips, \$30 add on module to SCRL. **FCC ID CODES**, \$10 add on module to SCRL. **SAMS PHOTOFACTS** complete listing, \$10 add on module to SCRL. Our products have been dubbed the BEST by hundreds of repairmen. Subscribe to our monthly updates and Save. Checks & credit cards accepted. E-Mail: sales@electronic-repair.com Web site: http://www.electronic-repair.com Custom Software Creators, PO Box 30415, Clarksville, TN 37040 931-647-6120.

Subscribe to Nuts & Volts.

Check out our web site and take advantage of our special subscription offer.

http://www.nutsvolts.com

For new subscribers OR renewals!



ACE COMPUTERS

(800) ACE-5936

Our 15th Year

(847) 952-6901 FAX

1425 East Algonquin Road

Arlington Hts, IL 60005

www.acecomputers.com

Home Office Pro

- Intel 430TX/440LX/BX Chipset w/512K Cache
- 64 Megs SDRAM
- 32X Speed CD-ROM Drive, Multimedia compatible
- 6.4 GB UDMA Hard Drive/1.44M Drive
- 56KB Fax/Modem with X2 Technology
- Diamond 3D Video PCI/AGP w/4M RAM
- Goldstar 17" SVGA Monitor - Flatscreen!
- Sound Blaster 64 Plug&Play with Subwoofer Speakers
- Microsoft Ergonomic Style Mouse/104 Keyboard
- Mini-Tower Case w/6 Bays
- Airmedia Wireless Internet Antenna
- Microsoft Win 95 or Windows NT 4.0 (Add \$99)
- Office 97 Professional

*P166MMX-\$1549	*P2-266-\$1849
*P200MMX-\$1579	*P2-300-\$1949
*P233MMX-\$1649	*P2-333-\$2149
*P2-233-\$1749	*P2-400-\$2499

SVGA Monitors

HUGE PRICE DROPS!	
Iiyama Visionmaster 350 - 15" 0.28 Dot Pitch, Digital, 1280 x 1024	\$239
Iiyama Visionmaster 8617E 0.26 Dot, 1600 x 1280, Digital	\$469
Iiyama Visionmaster 9017E, 0.25 AG - PC Editor's Choice 9/97	\$549
Iiyama Visionmaster 450 - 19" Monitor - 0.26 Pitch - PC World Best Buy	\$729
Iiyama Visionmaster 8721, 21" Monitor, 1800 x 1440 Resolution	\$1099
Iiyama Visionmaster 9221E, 21" Diamondtron, 1800 x 1440 Resolution	\$1149
Iiyama Visionmaster ProLite 36 CM LCD Monitor - Incredible Screen	\$999
Megaplus 14" Non-Interlaced 0.28 Dot Pitch	\$149
Megaplus 15" Non-Interlaced 0.28 Dot Pitch	\$199
Sony Multiscan 15sf Trinitron, Digital	\$329
KDS VS-7 17" Non-Interlaced 0.28 Dot Pitch, 1280 x 1024	\$299
Megaplus 17" Non-Interlaced, 0.28 Dot Pitch, 1280 x 1024	\$349
Goldstar 17" Non-Interlaced, 0.26 Dot Pitch, 1600 x 1280	\$369
KDS VS-9 17" Non-Interlaced 0.26 Dot Pitch, 1600 x 1280	\$399
Panasonic S70, 0.27 Pitch, 3 Year warranty-1 Year onsite!	\$449
NEC Multisync XV17+ - 0.25 Dot Pitch, ChromaClear, Digital	\$499
KDS VS-19 19" SVGA 0.26 Dot Pitch, Excellent	\$579
MAG Innovation MX-21F, 0.28 FST	\$1299
NEC Multisync P1150, 0.28 Dot Pitch	\$1799
Sony SP0300 SFT, 0.25 AG, Trinitron Tube	\$1899
Viewsonic 21-810	\$1299

Motherboards for

Pentium® Processors	
BCM 575 AT/550 ATX-430TX, P75-233PCI w/512K, DIMM	\$109
Tyan Tomcat, Single/Dual CPU, w/8 SIMMs, 512K	\$149/\$159
Tyan Turbo-2 AT/ATX, Intel 430TX w/6 SIMM/2 DIMM 512K	\$139
SuperMicro P55MMS98-Intel 430TX, 512K	\$149
ASUS TX97/TX97E, AT-430TX, P75-233 PCI w/512K	\$149

Motherboards for the Pentium® Pro Processor

BCM 600 - 150-200 MHz, Intel 440FX Chipset, PCI/ISA	\$199
Supermicro AT or ATX 150-200, Intel 440FX, PCI/ISA	\$219
Tyan Titan Pro - Single/Dual processor PCI/ISA, AT or ATX \$209/\$279	
Intel PR440FX - Dual Pro, UW SCSI, 10/100 LAN, Audio, ATX	\$449

Motherboards for the Pentium® II Processor

BCM 632 - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX	\$129
BCM QS440BX - Intel 440BX Chipset, PCI/ISA/AGP/DIMMs, ATX	\$179
Intel AL440LX - Intel 440LX, PCI/ISA/AGP/DIMMs, Audio, ATX	\$199
Intel SE440BX - Intel 440BX, PCI/ISA/AGP/DIMMs, Audio, ATX	\$229
Asus P2L97/P2L97S - Intel 440LX, PCI/ISA/AGP, ATX, SCSI	\$179/\$229
Supermicro P6SLS/DLS-440LX, Single/Dual P2, 2940UW SCSI	\$249/\$349
Supermicro P6SBS/DBS-440BX, Single/Dual P2, 3940UW SCSI	\$349/\$449
Sottek SL61B-440LX, PCI/AGP/ISA-AT FORM, SIMM/DIMM!!	\$179
Sottek SL67AC / SL67A - 440BX - With/Without SCSI2	\$259/\$159

Closeout boards for the Pentium® Processor

Tyan Tomcat I/II - Intel 430HX, Single or Dual Processor	\$99/\$129
Tyan Titan III/Titan VX - Intel 430FX/VX, 256K Cache	\$79
Ilwill Triton with onboard Adaptec Wide SCSI2	\$189

Dreamedia Station

- Intel 430TX/440LX/440BX Chipset w/512K Cache
- 64 Megs SDRAM memory
- Creative Labs DVD-2 ROM Drive
- 9.1 GB 7200RPM Hard Drive/1.44M FDD
- 56KB Fax/Modem with X2 Technology
- Matrox Millennium II(AGP) w/8M WRAM on board
- 17" Iiyama Visionmaster Pro w/0.25 Pitch
- Genuine Sound Blaster 64 AWE w/Subwoofer Spkrs
- Microsoft Ergonomic Style Mouse/104 Keyboard
- Industrial Mid-Tower Case with 8 Bays
- Airmedia Wireless Internet Antenna
- Microsoft Win 95 or Windows NT 4.0 (Add \$99)
- Add Office 97 Professional Only \$199!!

*P200MMX-\$2699	*P2-300-\$3049
*P233MMX-\$2749	*P2-333-\$3199
*P2-233-\$2799	*P2-350-\$3399
*P2-266-\$2899	*P2-400-\$3549

Memory/Microprocessors

30 Pin SIMM Modules	
1M x 9 SIMM/SIPP	\$8/\$10
4M x 9 SIMM	\$23
72 Pin SIMM Modules	
4M NonParity/EDO/Parity	\$12/\$12/\$25
8M NonParity/EDO/Parity	\$16/\$15/\$29
16M NonParity/EDO/Parity	\$21/\$20/\$39
32M NonParity/EDO/Parity	\$49/\$45/\$59
64M EDO/Parity	\$149/\$179
168 Pin DIMM Modules	
16M SDRAM 10 ns	\$35
32M SDRAM 10 ns/PC100	\$39 / \$59
64M SDRAM 10 ns/PC100	\$89 / \$139
128M SDRAM 10 ns/PC100	\$179 / \$249
Microprocessor Chips	
Pentium® II-400/350 Mhz	\$779/\$599
Pentium® II-333/300 Mhz	\$469/\$359
Pentium® II-266/233 Mhz	\$249/\$219
Pentium® Pro 200 Mhz -256K	\$349
Pentium® Pro 180 Mhz/150 Mhz	\$199/\$149
Pentium® 233 MMX/200 MMX	\$119/\$99
Pentium® 200 Mhz/166 MMX	\$139/\$89
Pentium® 166 Mhz/133Mhz	\$85/\$75
AMD K6 - 233/200 MMX	\$99/\$79
Pentium® II /Pro/Pentium® Fans	\$12/\$15/\$8

CD-ROM/Modems/Sound

CD ROM Drives	
Mitsumi EIDE 4X, 145 ms	\$34.99
Toshiba EIDE 32X, 85 ms	\$69.99
Toshiba 32X SCSI2, 80 ms	\$109.99
Plextor 32X SCSI2, 80 ms	\$229.99
Mitsumi 2X/8X CD-Writer	\$249.99
HP CD-Writer EIDE/Ext Parallel	\$399/\$489
Teac 4X/12X CD-Writer SCSI2	\$429.99
Plextor 4X/12X CD-Writer SCSI2	\$469.99
Creative Labs DVD2 Encore Kit	\$299.99
Modems	
56K X2 Compatible with Voice	\$69
USR Sportster 56K Int/Ext	\$119/\$149
USR 56K Courier Int/Ext	\$175/\$205
Diamond Supra 56K V.90 Int/Ext	\$79 / \$109
Sound Cards	
Ensoniq PCI 3D Sound Card	\$49.99
Diamond Monster Sound MX80	\$89.99
Creative Sound Blaster 16 PNP	\$39.99
Creative Sound Blaster 64 Value	\$69.99
Creative Sound Blaster 64 Gold	\$169.99

Network Equipment

Network Interface Cards	
Microdyne NE2000 - ISA Coax/AUI Network Card	\$14.99
Microdyne Home Gaming Kit (2 Cards, Coax Cable)	\$24.99
Microdyne NE2500 - ISA Twisted Pair Network Card	\$29.99
Microdyne NE2500 - ISA Combo Network Card	\$39.99
3Com Etherlink III - ISA Combo Network Card	\$79.99
Microdyne NE2500 - ISA Combo 5 Pack	\$119.99
Microdyne NE5500 - PCI Twisted Pair Network Card	\$49.99
Microdyne NE5500 - PCI Twisted Pair 5 Pack	\$179.99
SMC Etherpower - Twisted Pair Ethernet Card	\$49.99
3COM Etherlink XL - PCI Twisted Pair Ethernet Card	\$59.99
SMC Etherpower - PCI Combo Ethernet Card	\$69.99
Microdyne NE5500 - PCI Combo Network Card	\$69.99
Microdyne NE5500 - PCI Combo 5 Pack	\$249.99
3COM Etherlink XL - PCI Combo Ethernet Card	\$89.99
SMC Etherpower II - 10/100 PCI Ethernet Card	\$69.99
3COM Etherlink XL - 10/100 PCI Ethernet Card	\$79.99
Intel Etherexpress Pro - 10/100 PCI Ethernet Card	\$79.99
Intel Etherexpress Pro - 10/100 PCI 5 Pack	\$349.99
Network Concentrators (Hubs)	
Asante 5 Port FriendlyHub	\$39
Bay Netgear 8 Port/16 Port Hub	\$79/\$119
SMC EtherEZ Hub 8 Port Desktop/16 Port Rackmount	\$139/\$379
3COM OfficeConnect 8 Port Hub	\$149
3COM Superstack 12 Port Rackmountable Hub	\$329
Call about Network Equipment Not Listed!	

Enhanced IDE & SCSI2 Hard Drives

Enhanced IDE and Ultra DMA Drives	
2.14 Gig Seagate, 12 ms access	\$129.99
2.14 Gig Western Digital, 10 ms access	\$129.99
2.14 Gig Quantum Fireball Ultra DMA, 9 ms	\$139.99
2.55 Gig Maxtor Diamondmax, 9 ms access	\$149.99
3.1 Gig Western Digital, 11 ms access	\$159.99
3.2 Gig Seagate Medalist Ultra DMA, 10 ms	\$149.99
3.2 Gig Quantum Fireball Ultra DMA, 9 ms	\$169.99
4.0 Gig Western Digital, 10 ms access	\$179.99
4.3 Gig Seagate Ultra DMA, 12 ms	\$169.99
4.3 Gig Quantum Fireball Ultra DMA, 9 ms	\$169.99
5.0 Gig Micropolis Mustang, 9 ms access	\$199.99
5.1 Gig Western Digital, 10 ms Ultra DMA	\$199.99
6.4 Gig Quantum Fireball, Ultra DMA, 9 ms	\$239.99
6.4 Gig Seagate Medalist, Ultra DMA, 11 ms	\$219.99
6.4 Gig Western Digital, 10 ms Ultra DMA	\$229.99
6.5 Gig Seagate Medalist Pro, 7200 RPM, 9 ms	\$289.99
6.4 Gig Quantum Fireball, Ultra DMA, 9 ms	\$299.99
8.6 Gig Seagate Medalist, Ultra DMA, 9 ms	\$279.99
9.1 Gig Seagate Medalist Pro 7200 RPM	\$399.99
11.5 Gig Maxtor Diamondmax, 9 ms	\$379.99
SCSI2 Drives	
2.1 GB Quantum Fireball Ultra SCSI, 9 ms	\$199.99
2.1 GB Quantum Atlas Ultra Wide, 9 ms	\$199.99
3.2 GB Quantum Fireball Ultra SCSI, 9 ms	\$249.99
4.3 GB Quantum Fireball Ultra SCSI, 9 ms	\$269.99
4.5 GB Seagate Barracuda Ultra/Ultra Wide, 7.9 ms	\$469/\$479
6.4 GB Quantum Fireball Ultra SCSI, 9 ms	\$349.99
8.7 GB Micropolis Tomahawk Ultra SCSI2, 8 ms	\$399.99
9.1 GB Micropolis Tomahawk UW SCSI2	\$429.99
9.1 Gig Seagate Barracuda Ultra2 Wide 7.9 ms	\$749.99
9.1 Gig IBM Deskstar Ultra Wide 7 ms	\$729.99
9.1 Gig Seagate Cheetah Ultra/Ultra Wide	\$949/\$999
18.2 Gig Seagate Cheetah Ultra/Ultra Wide	\$1899.99
23.2 Gig Seagate Elite Ultra/Ultra Wide	\$1899.99
SVGA Cards and Accelerators	
Trident PCI with 2M DRAM / AGP with 4M	\$39 / \$79
Diamond Stealth 3D, 2M/4M DRAM PCI	\$59/\$79
ATI Video Xpression 2M PCI	\$49
Diamond Monster 3D II-8M/12M 3DFX Voodoo2 Chipset	\$229/\$299
Matrox Mystique 220 PCI with 4M RAM	\$99
Matrox Millennium II PCI/AGP 4M/8M WRAM	\$149/\$199
Matrox Millennium II Rainbow Runner/TV Tuner	\$199/\$99
ATI Xpert @ Work/Xpert @ Play AGP 4M (8M + \$50)	\$99/\$129
Diamond Viper 330 Pro AGP with 4M RAM	\$99
ATI All in Wonder Pro PCI/AGP 4M/8M	\$219/\$269

*We accept all major credit cards. We accept Fortune 1000, Government, and Educational Institution Purchase Orders. We respond to invitations for governmental and educational open bids. Business leasing available to qualified applicants. Prices, appearance, and specifications subject to change without notice. 17" monitors are 15.9" VHS or better, 19" monitors are 18.0" VHS or better. Certain models may include upgraded components. All custom configurations are available. 15% restocking fee on returns of custom-built systems. 30 day return policy does not include shipping charges, incurred damages, or service charges. All returns must include original packaging, accessories, and documentation in as-new condition. Monitors may be manufactured by third parties. Viewable sizes of monitors vary. The Intel inside logo and Pentium are registered trademarks of the Intel Corporation. Prices valid when ordered with this ad.



ACE COMPUTERS 1-800-ACE-5936

Delivering Power and Performance for Less Since 1983 www.acecomputers.com

WE BUY & SELL!

C and H

50 YEARS IN BUSINESS

SALES COMPANY

2176 E. Colorado Blvd.
Pasadena, CA 91107

Take advantage of our special purchase on TEST EQUIPMENT

HIGH PRECISION DIGITAL MULTIMETER

FLUKE, Model 8810A. LED readout. 5-1/2 digit auto-ranging multimeter. Has ohms converter and true rms options. Accuracy AC volts 0.1% to 0.5%, AC rms 0.2% to 0.4%, DC volts 0.01%, ohms 0.02% to 0.2%. Max input voltage 1000 VDC or peak AC. Input impedance to 1 to 1000 meg ohms depending on range. Power input voltage 115 VAC 50/60 Hz. Has built-in carrying handle that can be used as a tilting base. Dimensions: 9-1/4" wide x 14-1/2" deep (including carrying handle) x 3-1/4" high.

Stock #TE9805

\$295.00

3-1/2 DIGIT DIGITAL MULTIMETER

FLUKE, Model 8000A. LED readout. Classic digital multimeter. Ideal companion to our Stock #TE9800 counter. Measures AC/DC volts/milliamperes plus ohms. Input range 0-200 mV to 1200 volts, 0-200 uA to 2000 mA. 0 to 2000 K ohms. Portable unit with carrying handle which also can be used as a tilt stand. Input impedance 10 meg ohms. Max. input voltage 1200 VDC or rms. Accuracy DC volts 0.1% of input +1 digit. AC volts 0.5% of input +2 digits 45 Hz to 10 KHz. Input power 115 VAC 50 to 400 Hz 5 watts. Dimen.: 8-1/2" wide x 12" deep (including carrying handle) x 2-1/2" high.

Stock #TE9801

\$75.00

MILLIOHMETER

HEWLETT PACKARD, Model 4328A. Designed to measure very low resistances. Measurement range 1m ohm to 100 ohms. Resolution 20 u ohms. Analog meter readout. Ideal for measuring contact resistance of switches or relays. This unit is also useful for measuring the resistivity of semiconductor devices. (Requires special 4 terminal probes which are not supplied, but probably are available from Hewlett Packard.) Power input: 115-230 VAC 48-66 Hz, 5 VA max. Dimensions: 5-1/8" wide x 11-1/2" deep x 6-1/2" high.

Stock #TE9812

\$200.00

200,000 COUNT DIGITAL MULTIMETER, FLUKE,

Model 8800A. LED readout. 6-digit, auto-ranging multimeter. Basic accuracy $\pm 0.05\%$. 15 ranges DC volts: ± 200 mV to ± 1200 V in 5 ranges accuracy $\pm 0.008\%$ or better. AC volts: 2 VAC to 1200 VAC in 4 ranges. Accuracy $\pm 1\%$ or better depending on frequency and range. Resistance 200 ohm to 20 meg ohms in 6 ranges. Accuracy $\pm 0.2\%$ or better. Input impedance: 1000 meg ohms or more on DC ranges, 2 meg ohms on AC ranges. Has complete overload protection and isolated inputs. Power input 110/230 VAC 50/60 Hz 8 watts. Built-in carrying handle that also acts as a tilt-up base. Dimensions: 3-1/2" high x 9" wide x 12-1/2" deep.

Stock #TE9815

\$100.00

3600 RPM DC MOTOR WITH OPTICAL ENCODER

PACIFIC SCIENTIFIC, #4VM82-004-4. 30 volts nom. input voltage. Permanent magnet, reversible servo motor. Has Hewlett Packard optical encoder. Ball bearings. No load speed at 30 VDC input is 4600 rpm. No load current 0.75 amp at 60 oz-in load rpm is 3600, current is approx. 6.6 amps. Torque constant is 9.1 oz-in per amp. Rotor inertia 0.0007 oz-in-sec². Terminal resistance 0.89 ohm. Optical encoder is similar to "HEDS 6000" series. Encoder has 1024 counts per revolution, two channel quadrature output. Outputs are TTL compatible. Encoder requires 5 VDC input at less than 50 mA input current. Dual shafts: front shaft is 3/8" dia. x 3/4" long. This shaft is tapped on the end 8X32 tpi. Rear shaft is 1/4" dia. x 7/16" long. This shaft has dual flats that measure approx 3/16" across. Motor has four 8X32 tpi tapped mounting holes on front. A 3-3/16" dia. centering pilot is also provided on the front face. Dimensions: 4" dia. x 5-1/2" long (excluding shafts.)

Stock #DCME9850

\$79.50

Call us first if you have surplus inventories of electronic, optical, or mechanical items for disposal

✓ Master Charge ✓ Visa ✓ American Express ✓ Discover

TOLL FREE: 1-800-325-9465

Write in 82 on Reader Service Card.

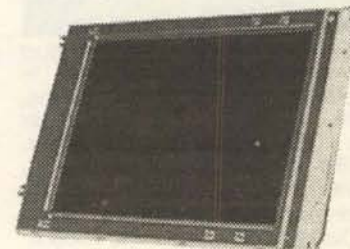
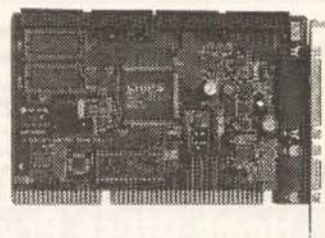
Flat Panel Display Solutions

VGA, TFT & STN LCD - LCD CONTROLLERS - TOUCH SCREENS

Earth has a broad line of VGA Flat Panel Display Solutions including ISA, P.C.I., NTSC, RS-232 & PC-104 Controllers. Monochrome & Color displays are available starting under \$100. Sizes from 6.3" to 14" are available. LCD monitors are available with and without Touch Screens. Our global sourcing of new and surplus displays assure you the best value in LCD monitors for industrial, embedded systems, kiosk and point of sale applications.

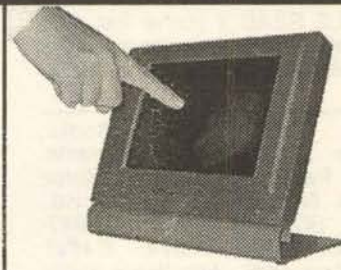
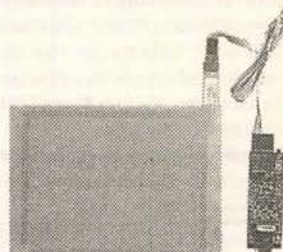
LCD CONTROLLERS

LCD DISPLAYS



LCD TOUCH SCREENS

LCD MONITORS



Get our current catalog on the web at <http://www.flat-panel.com>



EARTH

Computer Technologies

1110 Calle Cordillera - San Clemente, CA 92673

Ph: (714) 361-2333 - Fax: (714) 361-2121

Email: oemsales@flat-panel.com

Write in 83 on Reader Service Card.

Continued from page 39

TECH FORUM

are available for \$25.00. Both PCLINK and MACLINK are available for \$47.00. Z88 Source Book, with three PC format disks of PD and shareware programs for the Z88 are available for \$9.00. Prices include shipping.

Above all are available from FWD Computing, Frank Davis, P.O. Box 17, Mexico, IN 46958 USA. 317-473-8031, Tuesday-Saturday only, 6pm-9pm. Fax 317-472-0783, 6pm-11am. E-Mail: fdavis@quest.net

I have two Z88s, but no PC of MAC. I have the Source Book (20 pages), but no disks, and it gives some information not in the Z88 manual.

The Z88 can be expanded to more memory. All my Z88 stuff came from Frank Davis.

Donald S. Lambert
Auburn, IN

ANSWER TO #4984 - APR. 1998

I am not aware of an existing program to read the serial ports of two

Radio Shack digital multimeters and plot the related data. However, it could be accomplished by breaking the problem into two steps.

First, connect each meter to a different serial port on the computer. The manual for the multimeter shows a sample BASIC program for reading the meter values. Modify that program to read one meter then the other, and write each value separated by tabs to a file.

Now import that file into Microsoft Excel or some other spreadsheet program and use the built-in charting tools to produce your plots.

Doug Smith
Roscoe, IL

ANSWER TO #5981 - MAY 1998

Since each octave is a frequency ratio of 2:1, and each octave contains 12 equal half-steps, a half-step has the ratio of $2^{1/12}$ or 1.0594631:1 — roughly 6%. To tune your turntable a half-step flat, it would need to run at roughly 31.33 RPM.

To tune it a half-step sharp, it would need to run at roughly 35.33 RPM.

Changing speed on a CD player is not quite so easy because of all the digital timing circuits involved. However, there are a few CD players built with this feature.

J & R Music World 1-800-221-8180 www.jandr.com advertises the Technics SL-PD988 CD changer, among others.

Sam Ash Music Store 732-572-0263 advertises the Denon DN600F CD Player (which is rack-mountable); they also have some larger dual-CD players with this feature.

In general, CD players made for "DJ" use have variable pitch, the DJs often use this to match the TEMPO of two songs when they're cross-fading from one to the other, it doesn't seem to bother them that they're playing the song in the wrong key. But if the singer ends up a few steps sharp and sounds like Mickey Mouse, so what? Look how popular the Bee

Gees were!

Greg Miller
via Internet

ANSWER TO #5988 - MAY 1998

The National Semiconductor MM5450 "LED display driver" is essentially a 34-bit serial-in, parallel-out data register in a 40-pin plastic package.

Apply 4.75 to 11 volts DC to VDD pin 20 and connect ground to VSS pin 1. Take data enable pin 23 low, set a data bit on DATA IN pin 22, then take the CLOCK IN line high and then low.

The data format calls for a "start" bit of logical "1" followed by 34 bits of data. At the 36th clock a LOAD signal is generated synchronously with the high state of the clock, which loads the bits in the shift registers into the latches that control the output buffers. Each output can sink up to 15 mA.

So you see, the assignment of data bits to the a, b, c, d, e, f, and g

TECH FORUM

segments of your seven-segment display device is entirely up to you.

The MM5450 is simply a big wide serial-in parallel-out data register with output buffers that can sink lots of current. It doesn't know anything about layout of seven-segment displays. It's probably the start bit shifting out the far end of the shift register that resets the shift register, because there must be a complete set of 36 clocks or the shift register will not clear.

Bit 1 is the first bit following the start bit and it will appear (when latched out) at pin 18. A logical '1' at the input will turn on the appropriate LED. Bit 2 appears at pin 17, and so on going clockwise around the 40-pin package (skipping pin 1, of course), bit 18 is on pin 40 and bit 34 is on pin 24.

Jack Dennon
Warrenton, OR

ANSWER TO #5987 - MAY 1998

When burning out "whiskers" in a NiCd cell, the "zapping" capacitor should be connected to the cell positive-to-positive. If you connect it with polarity reversed, you will have a high current flow through the cell which may cause damage, and you may also reverse-charge the cell.

I have typically used a "zapping" voltage of around 12 VDC, connected to a single NiCd cell which is nom-

inally around 1.2 VDC. You want to keep the "zapping" pulse fairly short in duration, to avoid over-charging and/or over-heating the cell.

The pulse duration can be controlled by using a capacitor with reasonably low capacitance, or else just use a momentary-contact switch between the capacitor and the cell, and close the switch just for a fraction of a second.

The fellow who taught me this trick suggested putting the NiCd cells under the desk before zapping them, just in case. I have never seen it happen, but in theory, if a cell is over-heated in the process (by excess current and/or pulse duration), it could explode.

Greg Miller
via Internet

ANSWER TO #5984 - MAY 1998

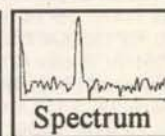
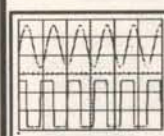
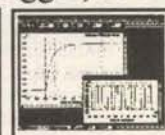
Well, I read and re-read this one about six or seven times, before I could make sense of it. Then it finally hit me, Arnaud was saying "SCAN" and meant "SWR" then it made sense. SWR is an acronym for standing wave ratio. SWR is the ratio of forward to reflected power.

The radio is working like it was designed. The antenna is working like it was designed. The problem is the radio covers a larger frequency span than the antenna is designed for. The antenna is "resonant" at 27 or so

Digital Storage Oscilloscopes

From \$189?

ATC modules connect to your PC printer port and transform it into a full-function DSO, spectrum analyzer, logger, & DVM. Units DC to 25MHz



Captured Waveforms
Pico Tech
ADC-200 in
Windows

O-Scope II
in DOS



ATC proudly announces the addition of Pico Technology Ltd. products to our product line. Pico is based in Britain and offers a variety of data logging and virtual instrument modules.

O-Scope Ip (ST 50KHz).....\$189
O-Scope II (DT 500KHz).....\$349
ADC-100 (DT 12bit 50KHz)..... \$449
ADC-200/20 (DT 10MHz)..... **CALL**
ADC-200/50 (DT 25MHz)..... **CALL**
Loggers 1-22 ch. (8-16 bit) from \$99
Shipping UPS \$7.50 grnd, \$11.50 (2 day)

800-980-9806

Allison Technology Corporation

8343 Carvel, Houston, TX 77036

Fax: 713-777-4746

Technical: 713-777-0401

BBS: 713-777-4753 email: atc@accesscomm.net

<http://www.atcweb.com>



- PRODUCT ENGINEERING
- FIRMWARE DEVELOPMENT

**"QUALITY
IS OUR
CAPITAL
CONCERN."**

- MICRO CONTROLLER & EPROM HARDWARE & SOFTWARE DEVELOPMENT

**Complete On Site
Electrical Engineering Lab**

- REVERSE ENGINEERING
- RF CIRCUIT DESIGN & MANUFACTURING

From Auto-Routing to CNC Routing to Electronic Assemblies...
Capital Electronics is Your Best Route For Printed Circuit Boards.

DESIGN/LAYOUT

- CAD LAYOUT SERVICES
- COMPATIBLE WITH ALMOST ALL CAD SYSTEMS
- FROM SCHEMATICS OR SAMPLE PCB'S
- PHOTOPLOTTING SERVICES
- 28,800 BAUDE MODEM

PRINTED CIRCUIT BOARDS

- SINGLE & DOUBLE SIDED
- MULTI-LAYER & FLEXIBLE PCB'S
- FROM QUICK TURN PROTOYPES TO SCHEDULED PRODUCTION RUNS
- FINE LINES, SMT
- ELECTRICAL TESTING
- PRECIOUS METAL PLATING

ASSEMBLY SERVICES

- FAST TURN BOARD STUFFING
- WIRE HARNESSSES
- WAVE SOLDERING
- ACQUISITION OF PARTS
- FINAL TESTING
- TURNKEY SERVICES
- CUSTOM ENCLOSURES

**For Quick & Competitive Pricing or More Information,
Please Call Us Today!**

303 Sherman Street • Ackley, Iowa 50601

(515) 847-3888

Fax (515) 847-3889 • Modem (515) 847-3890

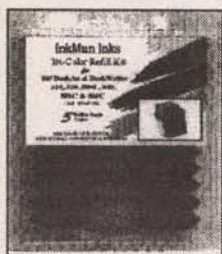


Internet Access:

For Automated Info Response:
INFO@capital-elec.com

E-Mail: Quote@capital-elec.com

Web Access: <http://www.capital-elec.com>



REFILL INKS FOR INKJET PRINTERS

Refill your old cartridge and save. All refill kits come with instructions and needed materials for refilling inkjet cartridges. Success guaranteed. Available for the following:

CANON BC-01, BC-02 CANON BJ10e, APPLE STYLEWRITER, BJ-200 Single, Black, \$8.00. **CANON BJC-600** (BC-201) Single Black or Single Colors (3 refills) \$8.00. **CANON BJ-130/300/330 & IBM Exec Jet** (Cart #BJL-481 & BJL-642) Black - 3-bottle kit \$22.00. **CANON BJC-210/240** (BC-05 Cart) 3-color kit (3 refills each color for BC-05) \$24.00. **CANON BJC-4000** and Apple Stylewriter 2400 Black 3-bottle kit (3 refills BC-20, 9 refills BCI-21 black, 30 refills BCI-11 black, 10 refills BCI-10) \$19.00. **CANON BJC-4000/BJC70** and Apple Stylewriter 2400 Tri-color kit - 6 refills each color for BCI-21 or 15 refills each color for BCI-11 \$24.00. **CANON BJC-800/820/880** 3-bottle kit (for BJI-643B) \$19.00. **CANON BJC-800/820/880** 3-bottle tri-color kit (Cart #BJL-643CMY) \$24.00. **EPSON STYLUS COLOR PRINTER** - (Cart S020034) Single Triple black \$19.00; Tri-color kit (Cart S020036) 2 refills each color \$24.00. **EPSON STYLUS COLOR II** - (S020047) Triple Black \$19.00 (S020049). Tri-color (2 refills each color) \$24.00. **EPSON STYLUS COLOR 400, 500, & 600** (S020093) Triple black (7 refills total) \$19.00; **EPSON STYLUS COLOR 200, 500** (S020097) Tri-color 3 refills each color \$24.00. **EPSON STYLUS COLOR 400, 600, 800, 1520** Tri-color (S020089) 3 refills each color \$24.00. **EPSON STYLUS 800/1000** (S020025) 3-refill kit, black, \$19.00. **HP DESKJET 500/550/560** (51608A, 51633A, 51626A) Black single refills \$8.00. **HP DESKJET 500/550/560**. Black 3-bottle kit \$19.00. **HP DESKJET 500C/550C/560C**. Tri-color kit (5 refills each color) \$24.00. **HP DESKJET 1200C, DESIGNJET 650** (Cart #HP 51640B) Black Three pack (3 refills) \$19.00. **HP DESKJET 1200C/1600C, DESIGNJET 650** (Cart #HP 51640 C,M,Y). Tri-color kit (one refill each color) \$24.00. **HP DESKJET 600/660** (HP 51629A) Black three pack \$19.00. **HP DESKJET 600C/660C**. (HP 51649A) Tri-color (5 refills each color) \$24.00. **HP DESKJET 855C/1600C** (HP 51645A) Black three pack \$19.00. **HP DESKJET 855C** (HP 51641A) Tri-color kit (2 refills each color) \$24.00. **HP PAINTJET and PAINTJET XL** (51606A) Black 3-bottle kit \$19.00. **HP PAINTJET and PAINTJET XL** (51606C) Tri-color kit \$24.00. **HP PAINTJET XL300** (C1645A & C1656A) Black 3-refill kit \$19.00. **HP PAINTJET XL300** Tri-color kit (1 refill each color) HP 51639C,M,Y \$24.00. **HP THINKJET, QUIETJET, KODAK DICONIX 150** (51604A or 92261A) black 5 refills \$9.00. **IBM/Lexmark/Execjet/4076** (1380620) black 3-refill kit \$19.00. **IBM/Lexmark Execjet IIC, WinWriter 150 C** (Cart #1380619) 4 refills each color \$24.00. **SNAP AND FILL SYSTEM** - Permits refilling HP 51626A (black for HP 500-series) and HP 51629A (black for HP 600-series) cartridges without making a hole in the cartridge. Consists of special cartridge holder, syringe, plastic tubing, and directions. **STARTER KIT** - with ink for 3 refills \$28.00. **EXTRA INK FOR SNAP & FILL SYSTEM** (black only) 4-oz. bottle \$18.00; 8-oz. bottle \$34.00. Specify whether for HP 51626A or HP 51629A.



HARD-TO-GET PRINTER RIBBONS

Gorilla Banana, Commodore 1525 \$8.00; Adam Coleco \$12.00; TI-850/855 \$6.00; Centronics 700 Zip Pack \$5.00; C. Itoh Prowriter Jr., Riteman C+/F+ \$6.00; Riteman Informer \$8.00; Commodore MPS-801 \$5.00; MPS 803 \$5.00; Decwriter LA30/36 \$4.00; Apple Scribe \$4.00; Mannisman Tally Spirit 80, Commodore 1526 \$5.00; Epson JX-80 4-Color \$14.00. Printronix P-1013 \$11.00; Star SJ144 color 3-pack \$29.00. ALSO HEAT & TRANSFER RIBBONS AND PAPER FOR PRINTING T-SHIRTS.

Over 300 different ribbons in stock. All ribbons new, not re-inked. Fully guaranteed.

Order directly or send SASE for complete list.

Add \$4.00 per order shipping. California residents add 7.75% sales tax. On ribbon orders over \$50.00 deduct 10% discount.

H.T. ORR Computer Supplies

249 Juanita Way, Placentia, CA 92870-2216

714-528-9822 • 800-377-2023 • FAX 714-993-6216

<http://www.extremeplay.com/occomp/orr.htm>

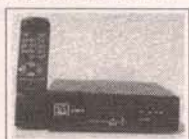
Write in 85 on Reader Service Card.

CABLE TV CONVERTER

Blow Out Price

★ Brand New Converter w/Remote — Call for Price

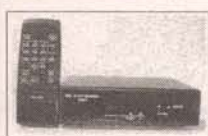
- ✦ We replace defectives with new units within 90 days
- ✦ Specifications ; Model : RA-550E



85 channels
AFT (automatic fine tuning)
HRC/STD switchable
Ch-3 RF out put
Parental lock
Sleep timer

★ Refurbished (by factory) Converter w/Remote — \$29/ea

- ✦ Call us for Q'ty price
- ✦ We replace defectives with another units within 30 days
- ✦ Specifications ;



54-550 Mhz
85 channels
AFT (automatic fine tuning)
HRC/Standard switchable
Ch-3 RF output
Parental control
Sleep timer

★ Parts/Components (ALL NEW)

IF Pack Module ----- Call for price
(Demodulator + RF Modulator)

Ch-3 in , Ch-3 out
+9V , +5V required
Video-In & Video-Out pins

✦ AC adapters — \$2.50/ea

Call for free brochures (spec)

Metro - Surplus Tel : (310) 515-5085/756-7710 (FAX)

COMPUTER PARTS

www.lapazusa.com

MEMORY UPGRADES

1Mx9-70 SIMM.....	\$12
4Mx9-70 SIMM.....	\$25
1Mx32/36-70 72-pin SIMM (4MB).....	\$11/22
2Mx32/36-70 72-pin SIMM (8MB).....	\$20/36
4Mx32/36-70 72-pin SIMM (16MB).....	\$35/49
8Mx32/36-60 72-pin SIMM (32MB).....	\$59/79
256Kx4 DIP DRAM.....	\$3

VIDEO

256Kx16-70 VIDEO SOJ (2CAS).....	\$6
256Kx16-70 VIDEO ZIP (2CAS/2WE).....	\$18/20

CACHE

64Kx1-15ns 22-DIP.....	\$5.50
32Kx8-25/20/15ns 28-DIP.....	\$3/2/2.50
64Kx8-15ns 32-DIP.....	\$5
128Kx8-15/20ns 32-DIP narrow.....	\$15 and up
128Kx8-15/20/25ns 32-DIP wide.....	\$15 and up

CPU

INTEL 486DX2-66 (5v) CPU.....	\$35
INTEL 486DX4-100 (5v) CPU.....	\$75
INTEL PENTIUM 133/166 CPU.....	\$95/125
80387SX/DX CO-PROCESSOR.....	\$19/32

MISC.

486 M/B 100Mhz, 256K, 8MB	\$119.00
PENTIUM M/B 133Mhz, 256K, 16MB	\$199.00
MMX ADAPTOR allows you M/B to accept MMX CPU's	\$35.00
AMD 486DX4-100+5v ADAPTOR + CPU FAN	
This kit will allow you to upgrade your old M/B to a faster CPU	\$65.00
LBA CARD upgrade your hard drive beyond 540MB without the expense of upgrading your present BIOS	\$29.95

ASK FOR OUR PENTIUM MOTHERBOARD UPGRADES FOR 386 AND 486 PACKARD BELL MODELS

PRICES SUBJECT TO CHANGE WITHOUT NOTICE -- TERMS: COD(CASH), VISA/MC -- MINIMUM ORDER \$20 -- SHIPPING & HANDLING: \$7 MIN. ORDER LINE: (800) 586-4199

LA PAZ ELECTRONICS INT'L

P.O. BOX 261095, San Diego CA 92196
TEL (619) 586-7610 FAX (619) 586-1482
e-mail: lapazusa@pobox.com

Write in 86 on Reader Service Card.

TECH FORUM

ANSWERS TO #49814 - APR. 1998

Most late model appliances use a sophisticated IR remote system designed for across-the-room range with no false responses. The IR emitter in the control box is driven by coded digital pulses modulating a 40-KHz carrier. The detector is well filtered, so it responds only to 40-KHz signals from the control box, not other ambient sources of light and heat.

Fortunately, you don't have to build a well-filtered detector for your repeater, because the work has already been done. A module containing a sensitive 40-KHz IR detector and filter is available at Radio Shack stores, part number 276-137. Output is a TTL-compatible digital data stream with the 40-KHz carrier removed.

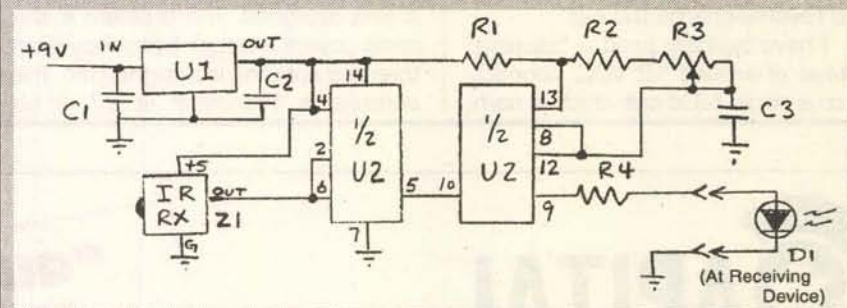
The schematic shows how I have incorporated that detector into a repeater. The detector gates a 40-KHz oscillator, made from half of a 555 timer. (The other half works as a logic inverter.) The oscillator drives an infrared LED which can be at the end of a cable that goes to the device to be remote-controlled. The circuit draws 18 mA. I powered mine from a nine-volt "wall wart" supply. The Radio Shack 273-1552 or 273-1432 nine-volt battery eliminator should work fine.

Construction and alignment of the repeater is easy with an oscilloscope. When you fire it up for the first time, leave the lead from the IR detector to U2-6 and U2-2 disconnected. Check the five-volt supply regulator output first. Then look for the five-volt digital stream at the detector output with a scope as you zap the repeater with your remote control.

Ground U2-6 and U2-2 and you'll get a continuous squarewave at pin 9. Adjust R3 to set the square-wave frequency to 40 KHz, using a frequency counter or well-calibrated scope time base. Now connect the wire from the detector to U2-6 and U2-2 and the repeater should be ready to go.

C1, C2	0.47 tantalum
C3	390 pF MICA
D1	IR emitter (RS 276-143)
R1	1K
R2	33K
R3	20K trimpot (RS 271-340)
R4	820
U1	7805 5V regulator (RS 276-1770)
U2	555 dual timer (RS 276-1728)
Z1	IR receiver assembly (RS 276-137)

Joseph D. Moell, P.E.
Fullerton, CA



MHz, approximately the center of the CB band. So at that frequency, the reflected power, or standing wave ratio is minimum. So the reading of 1.5:1 ± .3 when used on the CB frequencies.

This is the design frequency of the antenna, and the maximum efficiency is obtained when the antenna is resonant at the desired frequency. When the radio is moved out of the CB bands into the Ham bands, the antenna is too low in frequency for the new higher transmit frequency, and the SWR goes up.

The antenna could be retuned to the new frequency by cutting the stainless steel rod shorter to accommodate a higher resonant frequency. However, doing so will make the SWR go up at the CB frequencies. And for legalities IE transmitting out of band it is probably best left as-is.

I just got an E-Mail about FCC busting New York cabbies for using CB radios out of band. So get a frequency chart of the CB frequencies, and stay on them. There are some frequencies within the band that fall between the 40-channels allocated by the FCC that are considered illegal frequencies. This is between channel

ELECTRONICS

Q & A

..... With TJ Byers

In this column, I answer questions about all aspects of electronics, including computer hardware and software. This column doesn't replace the Tech Forum that you've grown to love and support. Instead, it will supplement it, so feel free to participate as always with your questions and answers. You can send your questions to me by E-Mail at q&a@nutsvolts.com, or by snail mail at Nuts & Volts Magazine, 430 Princeland Ct., Corona, CA 91719.

What's Up:

Piezo coaxial cable update, alpha wave stimulator, and an AC-line monitor. **Computer topics:** old monitor conversions and CMOS set-up questions answered.

Piezo Coaxial Sensors ... Again

Q. I'm very interested in your solution to the driveway sensor problem in the Feb. '98 issue. The piezo coaxial cable you mentioned sure seems like the answer to my problem. However, I'm not on the Web, so I'd like a snail mail address of the company that sells the piezo cable. A schematic of the control unit would be nice, too.

B. L. "Frenchy" Mestayer
Brazoria, TX

Q. Please expound on the subject of piezo coaxial cables. I am very interested in its use and the control circuitry needed to detect the presence of automotive traffic.

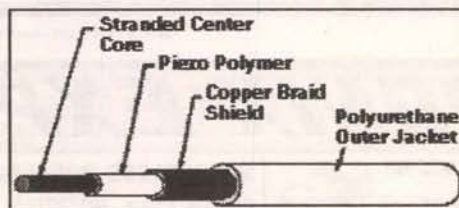
Steve Craddock
via Internet

A. Boy, has the mention of this product raised a lot of response. First, the contacts.

AMP Sensors Americas
Glen MacGibbon
P.O. Box 799
Valley Forge, PA 19482
Tel: 610 650-1500
FAX: 610 650-1509
E-Mail: sensors@amp.com

Pete Smith
172 Big Valley Road
Folsom, CA 95630
Tel: 916 983-8644
FAX: 916 983-0479
E-Mail: prsmith@amp.com

Now, the dialog. The AMP piezo coaxial cable has the appearance and characteristics of standard coaxial cable, but is constructed with a piezoelectric polymer insulator between the inner copper conductor and the outer braid shield.



The cable can be buried for perimeter fence security, traffic sensors with vehicle classification, and other safety and security applications. Other applications include sensors for floor mats, touch pads, and door edges. The piezo cables feature the same piezoelectric properties that are characteristic of piezo film sensors — the kind used in piezo buzzers. In its normal, relaxed state, the piezo cable behaves like a regular coaxial cable with the normal impedance/capacitance restrictions that you'd expect from a typical RG58A/U (20 AWG) coaxial cable. But if you bend, twist, or physically distort the cable in any way, the piezoelectric insulator produces a "lightning bolt" spark between the inner conductor and the outer shield. The electrical output is proportional to the stress imparted to the cable.

Parameter	Units	Value
Capacitance @ 1kHz	pF/m	600
Tensile Strength	MPa	60
Young's Modulus	GPa	2.3
Density	kg/m ³	1890
Acoustic Impedance	MRayl	4.0
Relative Permittivity	@1kHz	9
$\tan \delta_e$	@1kHz	0.017
Hydrostatic Piezo Coefficient	pC/N	15
Longitudinal Piezo Coefficient	Vm/N	250×10^{-3}
Hydrostatic Piezo Coefficient	Vm/N	150×10^{-3}
Electromechanical Coupling	%	20
Energy Output	mJ/Strain (%)	10
Voltage Output	kV/Strain (%)	5

Kynar® Piezo Cable Typical Properties

The linear dynamic range of the cable is about 200 dB, which spans the range from a rain drop to an 18-wheeler. Herein lies the con-

Top Quality Reconditioned Electronic Test Equipment

Hewlett-Packard • Tektronix • Fluke • Wiltron

BOUGHT & SOLD

Test Equipment Wanted

Looking for Test Equipment Manuals?

Contact: Manuals Plus (801)882-7188 • Fax (801)882-7195

Corporate Offices
P.O. Box 1762
San Mateo, CA 94401

Seattle, WA 206-251-6653
285 S.W. 41st St.
Renton, WA 98055

415-579-1711 • Fax 415-579-5777

<http://www.bellelect.com>



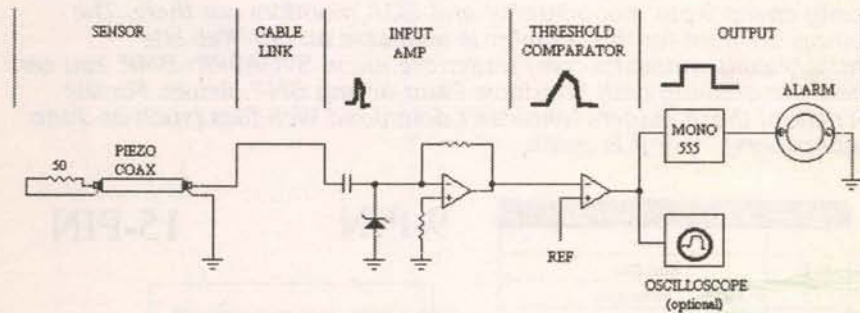
BELL
Electronics

ALL CABLE TV NEEDS

CABLE KING

1-800-544-9494

trol circuitry design problem. A truck generates a lot higher voltage spike than does a rain drop — and the input amplifier must react accordingly. Typically, the amplifier is designed for a specific range. Let's say foot steps on a carpet, with over-voltage protection should a wheel chair come across the path. Because of this wide dynamic range, I can't give you the exact values for an amplifier that can cope with your specific stress pressures. However, I can block out a circuit for you. I've broken it into five stages.



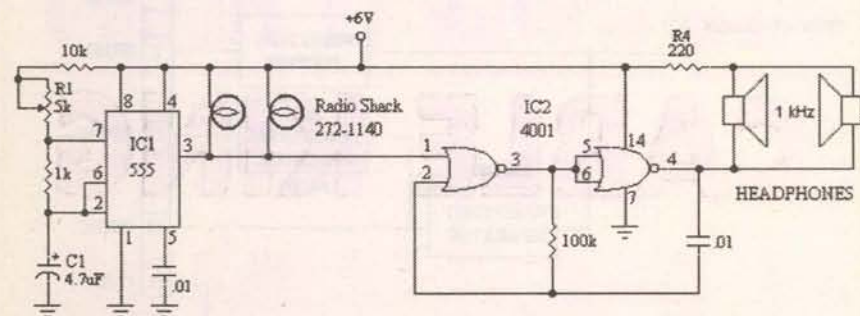
The first stage is the piezo coax cable itself. While the cable can pass a signal (such as an audio message between a gate speaker and your home), it's most likely you'll want to use it just to alert the passage of an object, like a car, across your parameter. If you don't have a signal source, a termination resistor is needed at the head end. The next step, stage 2, is the link between the piezo coax sensor and the controller (which consists of stages 3 through 5). Because it is coaxial, you can run the piezo cable right up to the input amp. Unfortunately, piezo cable isn't cheap. The price is \$16.50 per meter, about \$5.00 a foot (part # 0-1002399-0), so for long runs it would be wise to use only as much piezo sensor as you need and splice it to a cheaper standard coax cable to finish the link. The AC-coupled input amp is any op amp that's responsive to voltage spikes of various amplitude. The gain of the op amp is adjusted so that the signal from the piezo sensor exceeds the limit of the comparator (stage 4); a zener across the input clamps the spike and prevents damage to the op amp. The amplified signal is then run through a comparator which prevents under-voltage events from triggering the 555 monostable alarm. AMP also sells a piezo cable experimenter's kit that contains about 10 feet of piezo cable, coaxial splices, a user's manual, and a whitesheet of typical applications. The cost is \$100.00.

Alpha Wave Generator

Q. A few years ago, I frequented a place in New York that provided "SynchroEnergizing," a form of hypnotic relaxation using sight and sound. Essentially, their SynchroEnergizers were safety goggles with small lightbulbs attached to headphones. The lights would flash while the headphones sounded a syncopated beep. The idea is that the light and sound frequency would, let's say, "smooth out your brainwaves." Apparently, certain frequencies put you into an alpha state ... kinda like slumberland. I won't rave about its results, but I enjoyed it and it certainly relaxed me. Do you know of any kits available for such devices? I suppose I could just build a simple 555-based oscillator, but how would I accurately control the frequency? How could I drive lightbulbs instead of LEDs?

Simon Gouldstone
via Internet

A. Been there and done that, but let me put up the warning flags before I answer this. Yes, 9 Hz to 13 Hz can be relaxing. HOWEVER, if you're prone to epilepsy or related disorders, this is not the toy for you! It can send you into a seizure within seconds. It's the alpha wave that most enjoy so much that sends some persons to the emergency room. I'm sure you had to sign your life away before this club would let you participate in the pleasures. Well, in the same way, I'm not responsible for the use of the following circuit, nor is Nuts & Volts Magazine. With that said, here's the circuit.



As you correctly assumed, a simple 555 chip is all that's needed. Well, actually we need two chips, one for sight and one for sound. IC1 is the clock chip and lamp driver. The values shown produce a 10 Hz

AST GLOBAL ELECTRONICS

24529 STATE HWY. 408, CAMBRIDGE SPRINGS, PA 16403
VOICE 814-398-8080 • 1-888-216-7159 • FAX 814-398-1176

VIEW COMPLETE LISTING AT:
<http://www.astglobal.com>

IF WE DON'T CARRY IT ... WE'LL FIND IT
QUICKLY ... AT REASONABLE PRICES.

Amber 3501A, Distortion & Noise Measuring System	\$275	HP 6206B, Power Supply, 0-60V @ 1A (metered)	\$250
Associated Research 4045A, Hipot/Megometer, 0-5KV @ 3mA	\$250	HP 6253A, Power Supply (dual), 0-25V @ 3A (metered)	\$225
Associated Research 5014A, DC Hipot, 0-3KVDC @ 2mA	\$250	HP 6260B, Power Supply, 10V @ 100A (metered)	\$400
Bontoon 428D, Microwatt Meter w/ Cable/Sensor	\$150	HP 6265B, Power Supply, 40V @ 3A (metered)	\$250
Dranetz PA6001, Plug-in Line Analyzer	\$175	HP 6266A, Power Supply, 40V @ 6A (metered)	\$250
Dranetz PA6011, Plug-in Time Monitor	\$175	HP 6289A, Power Supply, 0-40 @ 1.5A (metered)	\$225
Dranetz PA6024A, Plug-in Harmonic Analyzer	\$275	HP 8011A, Pulse Generator, 1Hz-20MHz	\$175
Dranetz PA6024B, Plug-in Harmonic Analyzer	\$300	HP 8013B, Pulse Generator, 1Hz-50MHz	\$275
Dranetz 626, Universal Disturbance Analyzer, Frame only		HP 8081A, Rate Generator (300MHz) w/8084A Word Generator	
w/Power Supply & Communication Plug-in	\$375	(300MHz) w/8083A Output Amp (300MHz)	\$950
ESI DP1311, Variable Resistor, 100K max 1K/Step	\$100	HP 8091A, Rate Generator (1GHz) w/8092A Delay Generator	
ESI 250DE, RLC Bridge (nice)	\$150	(1GHz) w/8093A Output Amp w/15401A & 15400A	\$3,000
Fluke 332B, DC Voltage Standard	\$475	HP 8157A, Optical Attenuator	\$375
Fluke 335A, DC Voltage Standard	\$475	HP 8180A, Data Generator	\$425
Fluke 382A, Voltage/Current Calibrator	\$525	HP 8182A, Data Analyzer	\$650
Fluke 515A, Portable Calibrator	\$675	HP 8410B, Network Analyzer Mainframe	\$275
Fluke 540B, Transfer Standard w/AS4-2 Voltage Plug-in	\$625	HP 8414A, Polar Display	\$225
Fluke 720A, Kelvin Varley Voltage Divider	\$750	HP 8443A, Tracking Generator w/Cables, 1KHz-110MHz	\$475
Fluke 721A, Lead Compensator	\$275	HP 8444A, Tracking Generator for 141T System, 5-1300MHz	\$750
Fluke 750A, Reference Divider	\$475	HP 8552A, IF Plug-in (for 140 Series Mainframes)	\$125
Fluke 780A, Meter Calibrator	\$450	HP 8553B, RF Plug-in (for 140 Series Mainframes), 1KHz-110MHz	\$425
Fluke 845AB, Null Detector/Micro Voltmeter 1uV-1000VDC	\$375	HP 8553L, RF Plug-in (for 140 Mainframes), use with 8552A, 1KHz-110MHz	\$125
Fluke 845AR, Null Detector/Micro Voltmeter 1uV-1000VDC	\$375	HP 8601A, Sweeper Generator, 1-110MHz	\$425
Fluke 893A, AC/DC Differential Voltmeter 0 to 1100 Volts, AC/DC, 0.1%DC, 0.5%AC, 1uV Resolution	\$100	HP 8614A, Signal Generator, 800-2400MHz, AM/FM Levelled	\$475
Fluke 3330B, Constant Current/Voltage Calibrator	\$675	HP 8616A, Signal Generator UHF, 1.8-4.5GHz, +10-126dB, AM/FM	\$475
Fluke 5100B, Multifunction Calibrator, Opt. 0305	\$3,250	HP 8640B, Signal Generator, 5-512MHz, Opt 001 or 003	\$950
Fluke 5100B, Multifunction Calibrator	\$2,700	HP 8656A, Synthesized Signal Generator, 100KHz-990MHz	\$1,650
Fluke 5101B, Calibrator	\$3,450	HP 8743A, Reflection Test Set, 2-12.4GHz	\$475
Fluke 5200A, Programmable AC Calibrator	\$1,250	HP 8901A, Modulation Analyzer	\$2,400

TURN IDLE TEST EQUIPMENT — INTO CASH — CALL OR FAX FOR QUOTATION

Fluke 5215A, Precision Power Amp	\$950	HP 8640B, Signal Generator, 5-512MHz, Opt 001 or 003	\$950
Fluke 6011A, Synthesized Signal Generator, 10Hz-11MHz (7-digit)	\$825	HP 8656A, Synthesized Signal Generator, 100KHz-990MHz	\$1,650
Fluke 8000A, DMM 3-1/2 Digit	\$75	HP 8743A, Reflection Test Set, 2-12.4GHz	\$475
Fluke 8050A, DMM 4-1/2 Digit w/Battery Pack	\$145	HP 8901A, Modulation Analyzer	\$2,400
Fluke 8050A, DMM 4-1/2 Digit w/Battery Pack	\$145	HP 8930A, D/A Converter	\$175
Fluke 8502A, DMM 6-1/2 Digit Opt. 02/03/05/07/08A (Ohms Conv., Cur. Shunts, IEEE-488, Interface Iso. Ext. Trig.)	\$425	HP 59501A, HP-IB Isolated D/A Converter	\$125
Fluke 8520A, DMM 5-1/2 Digit	\$325	Huntsville 80-D, Micro Systems Troubleshooter	\$225
Fluke 8600A, DMM 4-1/2 Digit w/Battery Pack	\$125	Huntsville 180P, Micro Systems Troubleshooter	\$350
Fluke 8800A, DMM 5-1/2 Digit	\$175	Kepco JCE 36-15MVPT, Power Supply, 0-36 @ 15A (metered)	\$275
Fluke 9005A, Logic Analyzer	\$275	Kepco JCE 36-3MVPT, Power Supply, 0-36 @ 3A (metered)	\$175
Fluke 9010A, Logic Analyzer w/2-80 Prods	\$350	Krohn-Hite 3103R, Variable Bandpass Filter, 10Hz-1MHz	\$150
General Radio 1390-B, Random Noise Generator	\$150	Krohn-Hite 3202R, Dual Channel Tunable Filter, 20Hz-2MHz, High Pass, Low Pass Band Reject	\$275
General Radio 1346, Audio Frequency Micro Voltmeter	\$125	Krohn-Hite 3750, Filter	\$275
Gould K105-D, Logic Analyzer w/4 Probe Prods	\$650	Racal Dana 9303, True RMS RF Level Meter	\$550
Guideline 9770B, Constant Current Source	\$125	Rockland 1022F, Dual HiLo Filter	\$150
HP 141T, Spectrum Analyzer Mainframe	\$475	Rockland 5100, Synthesizer, DC-2MHz, .001 Hz Resolution	\$325
HP 141T, Spectrum Analyzer w/8552A/8553B, 1KHz-110MHz	\$1,000	Sencore SC61, Scope (100MHz) w/New Probes, Dual Trace	\$750
HP 141T, Spectrum Analyzer w/8552B/8553A, 1KHz-110MHz	\$1,100	Sencore SC61, Scope (100MHz) w/Probes, Dual Trace	\$500
HP 141T, Spectrum Analyzer w/8552B/8554B, 1KHz-1.2GHz	\$1,700	Sencore TVA92, TV Video Analyzer	\$1,100
HP 141T, Spectrum Analyzer w/8552B/8555A, 10MHz-18GHz	\$1,900	Sencore VC63, VCR Test Accessory	\$100
HP 180TR, Scope Mainframe	\$250	Sencore VG91, Universal Video Generator	\$1,200
HP 182T, Spectrum Analyzer Mainframe	\$350	Sorenson DCS-300-3.5, Power Supply, 0-300V @ 3.5A (non-metered)	\$375
HP 214A, Pulse Generator, 0.8V-100V	\$250	SRL 112B, PLO/PRF Synthesizer	\$125
HP 334A, Distortion Analyzer	\$275	SRM 262, Y Band Filter	\$100
HP 350D, Attenuator	\$175	Tek 475/DMM44, Scope (200MHz), Dual Trace w/DMM	\$575
HP 400EL, AC Voltmeter, 10Hz-10MHz	\$150	Tek DC503, Plug-in Counter Unit, 100MHz	\$150
HP 400FL, RMS Voltmeter, 20Hz-4MHz, 100uV-300V	\$175	Tek DM501A, Plug-in DMM, 4-1/2 Digit	\$175
HP 403B, AC Voltmeter Battery Operated, 5Hz-2MHz, 1mV-300V	\$175	Tek DM502, Plug-in DMM, 4-1/2 Digit	\$150
HP 415E, SWR Meter	\$100	Tek FGS01, Plug-in Function Generator, .001Hz-1MHz	\$175
HP 427A, Multi-function Meter (AC, DC & Resistance 10Hz-1MHz)	\$100	Tek FGS04, Plug-in Function Generator, .001Hz-40MHz	\$450
HP 432A, Power Meter w/Cable/8478, 0.1-18GHz Sensor	\$350	Tek PGS01, Plug-in Pulse Generator, 5Hz-50MHz	\$175
HP 432A, Power Meter w/Cable/Sensor	\$250	Tek PSS03A, Plug-in Power Supply Triple	\$175
HP 435A, Power Meter w/Sensor/Cable	\$175	Tek TM504, Power Module, 4 Slot	\$125
HP 651B, Test Oscillator, 10Hz-10MHz	\$150	Tek TM506, Power Module, 6 Slot	\$200
HP 652B, Test Oscillator, 10Hz-10MHz	\$150	Tek OIG-502, Plug-in Optical Impulse Generator (unused)	\$1,500
HP 654A, Oscillator, 10Hz-10MHz, 90dB Attenuator	\$225	Tek PS501-1, Plug-in Power Supply	\$150
HP 1980B, Scope Measurement System w/1965A Gated Universal Timer (like new)	\$550	Tek 7A16A, Plug-in (225MHz), Single Trace Amp	\$100
HP 3312A, Function Generator, 1Hz-13MHz	\$490	Tek 7A18, Plug-in (75MHz), Dual Trace Amp	\$75
HP 3325A, Programmable Frequency Synthesizer 1Hz-32MHz	\$1,650	Tek 7A19, Plug-in (600MHz), Single Trace Amp	\$150
HP 3330B, Automatic Synthesizer, 20Hz-13MHz	\$325	Tek 7A26, Plug-in (200MHz), Dual Trace Amp	\$150
HP 3400A, True RMS Voltmeter, 10Hz-10MHz, 1mV-300V	\$200	Tek 7B50A, Plug-in (150MHz), Time Base	\$100
HP 3403C, True RMS Meter, AC/DC/8B 100MHz	\$325	Tek 7B53A, Plug-in (100MHz), Dual Time Base	\$125
HP 3406A, RF Voltmeter, 50V-3V, 1.2GHz	\$350	Tek 7B70, Plug-in (200MHz), Time Base	\$75
HP 3455A, DMM 5-1/2 Digit	\$250	Tek 7B80, Plug-in (400MHz), Delayed Time Base	\$150
HP 3456A, DMM 6-1/2 Digit	\$525	Tek 7B92A, Plug-in (500MHz), Dual Time Base	\$200
HP 3466A, DMM 4-1/2 Digit, AC/Battery, 5 Function	\$225	Tek 7D11, Plug-in Digital Delay	\$175
HP 3551A, Transmission Test Set (Portable) Unused	\$750	Tek 7D13, Plug-in DMM 3-1/2 Digit	\$125
HP 3580A, Spectrum Analyzer, 5Hz-50KHz, LED Readout	\$850	Tek 7D15, Plug-in Counter/Timer, DC-225MHz	\$225
HP 3581A, Wave Analyzer, 15Hz-50KHz	\$475	Tek 7S11, Plug-in Sampling Unit	\$175
HP 3586C, Selective Voltmeter	\$475	Tek 134, Current Probe Amp	\$100
HP 3762A, Data Generator, 30-150MHz	\$450	Tek 465, Scope (100MHz), Dual Trace	\$425
HP 3770A, Amplitude/Delay Distortion Analyzer	\$425	Tek 465B, Scope (100MHz), Dual Trace	\$475
HP 3779B, Primary MPX Analyzer	\$625	Tek 466, Scope (100MHz storage), Dual Trace	\$575
HP 3781B, Pattern Generator	\$300	Tek 475, Scope (200MHz), Dual Trace	\$475
HP 4277A, LCZ Meter	\$2,400	Tek 475A, Scope (250MHz), Dual Trace	\$625
HP 5314A, Counter/Timer, 100MHz (unused)	\$175	Tek 485, Scope (350MHz), Dual Trace	\$850
HP 5328A, Counter, 100MHz w/DMM/Opt. 021	\$250	Tek 520A, NTSC Vectorscope	\$575
HP 5328A, Counter, 500MHz	\$350	Tek 2213, Scope (60MHz), Dual Trace	\$375
HP 5345A, Counter, 500MHz, HP-IB	\$450	Tek 2236, Scope (100MHz) w/Counter/Timer/DMM	\$800
HP 6104A, Precision Power Supply, 20V @ 3A, 20-40V @ 1A (metered)	\$175	Tek 2445, Scope (150MHz), 4-Channel Cursor Readout	\$1,700
HP 6112A, Power Supply, 40V @ .5A (metered)	\$175	Tek 2465, Scope (300MHz), 4-Channel Cursor Readout	\$2,400
HP 6116A, Power Supply, 0-100V @ 200mA (metered)	\$125	Tek 7603, Scope Mainframe (100MHz)	\$200
HP 6202B, Power Supply, 40V @ .75A (metered)	\$175	Tek 7704A, Scope Mainframe (250MHz)	\$325
HP 6203B, Power Supply, 7.5V @ 3A (metered)	\$175	Tek 7854, Scope (400MHz), Dual Beam w/Waveform Calculator	\$625
HP 6205B, Power Supply (dual), 0-40V @ .3A, 0-20V @ .8A (metered)	\$225	Tek 7904, Scope Mainframe (500MHz)	\$350



- 60-DAY WARRANTY
- 10-DAY RIGHT OF RETURN
- SATISFACTION GUARANTEED

flash rate with a 20% duty cycle — which, when used with an incandescent lamp, will tickle your alpha waves. R1 adjusts the flash rate between 9 Hz and 15 Hz. The 555 chip can output 300 mA of current, which is enough to light any of the mini lamps sold by Radio Shack. I recommend two or four 272-1140 bulbs glued into the sides of a pair of cheap plastic safety glasses (the kind you can find at any hardware store). You can parallel as many of these bulbs as you — and the 555 chip — can stand. Because these glasses are clear, either paint the lens with a reflective color or do your tripping in a darkened room. The sound comes from a 4001 logic chip (IC2) that's configured as a gated tone source. When the 555's output goes low, and the bulbs flash, the tone source sounds. Any headphone will work. Too loud? Increase the size of R4 to 470 ohms. The circuit draws very little current and can be powered by four AA batteries.

Flash BIOS

Q. Could you explain to me what a "flash" BIOS is? Also, how do you do it?

Joe Spinola
via Internet

A. Basically, there are two types of BIOS (Basic Input/Output System) chips used in computers. The first is the ROM, which stands for Read-Only Memory. This type of BIOS is programmed at the factory using a logic "mask" and its instructions are forever carved in stone, literally. A flash BIOS, on the other hand, is an EEPROM (Electrically Erasable Programmable Read-Only Memory) that is programmed at the time the PC is shipped. This type of BIOS can be erased and programmed with a different set of instructions. Generally this is done by downloading a routine from the vendor's Web site, or by a diskette that you can order (usually just for the cost of shipping and handling) from the vendor. Before you update, though, compare your current version number to the one being offered, because the EEPROM is good for only 100 erasures. Given the life of a PC, this is plenty, but if you do it frequently you could end up with a Ronny Reagan PC — one with no memory. I certainly wouldn't upgrade from 2.01.01 to 2.01.02. I'd wait for the 2.5 version unless there's a major bug fix.

Old Monitors Still Live!

Q. I have an old MultiSync monitor with an analog/digital switch that I'd

like to use with a VGA card. I understand you showed a schematic of an adapter cable that will do this in your May '97 column. Can you give me the pinout for this 9- to 15-pin adapter, and have there been any modifications since it was published?

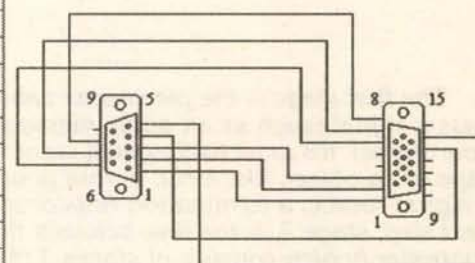
Evert Anderson
via Internet

A. Just today a friend called and asked if I could solder up this very cable for him. Why is this fix so popular? Because there are a lot of really cheap 9-pin monochrome and EGA monitors out there. The wiring diagram for this adapter is available on our Web site (<http://www.nutsvolts.com>) under the name SVGA9PIN.BMP. You can view the drawing with Windows Paint or any BMP viewer. For the benefit of those readers who can't download Web files (such as Juno subscribers), here it is again.

15-Pin	9-Pin	Description
1	1	Red gun
2	2	Green gun
3	3	Blue gun
4	--	Monitor ID bit 2
5	--	no connection
6	6	GND (red return)
7	7	GND (green return)
8	8	GND (blue return)
9	--	no connection
10	--	GND
11	--	Monitor ID bit 0
12	--	Monitor ID bit 1
13	4	Horizontal sync
14	5	Vertical sync
15	--	no connection

9-PIN

15-PIN

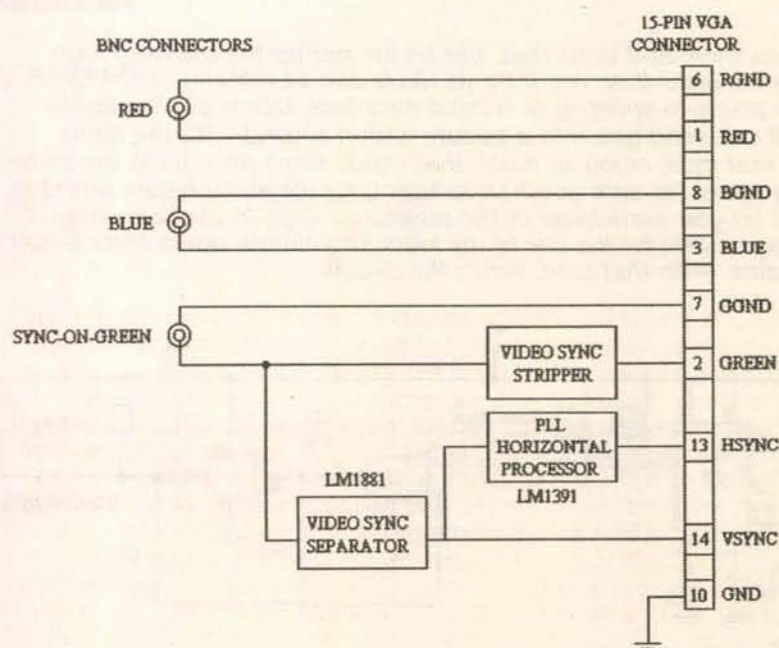


RGB to SVGA Converter

Q. I have an old Hewlett-Packard UNIX computer with three BNC video outputs (RGB) that I wish to use with my SVGA monitor. Is there an interface available or a circuit that I can build to accomplish this?

Chuck Karbinsky
via Internet

A. This is tricky because the sync signals are buried in the green output. Let me explain. All color video displays — including your TV — require five signals: red video, green video, blue video, horizontal sync, and vertical sync. All PCs, including your HP, have these signals in one form or another. In a VGA monitor they are five separate signals with five dedicated pins or five BNC connectors. A monitor with four BNC connectors combines the horizontal and vertical syncs into a composite signal. Other computers, like your HP and Macintosh systems, reduce the number of connections to three by combining the composite sync with the green video, called sync-on-green (the red and blue remain separate). So what you have to do is strip the composite sync from the green output then untangle the horizontal from the vertical and route them to separate outputs. While it's a complex process, it's been simplified with the advent of IC chips called sync separators, like the LM1881. Okay, how do you do it? Like this.



In this circuit the video sync separator strips the green video from the composite signal and outputs a composite sync (horizontal and

COUNTERSURVEILLANCE COVERT SURVEILLANCE

VIBRATING TRANSMITTER DETECTOR

DETECTS:

- Body Wires
- FM Wireless Mics
- AM Transmitters
- UHF Transmitters

AI-2100 ... \$140.00

TRVD-900

DETECTS:

- Body Wires • Transmitters
- Tape Recorders • Video Equipment

TRVD-900 ... \$395.00

BLACK BOX COLOR CAMERA

BX-985 ... \$195.00

SMOKE DETECTOR COLOR CAMERA

SD-985 ... \$275.00

COVERT COLOR VIDEO LAMP

- 380 (H) TV Lines
- 2 Lux Sensitivity
- Undetectable Lens

VL-985 ... \$395.00

AI-5500 COMPLETE SAFETY SYSTEM

DETECTS:

- All Phone Taps
- All Body Wires
- All Transmitters

DISRUPTS:

ALL TRANSMITTERS & BODY WIRES WITH ITS BUILT-IN
WHITE NOISE SIGNAL BREAKER AI-5500 ... \$350.00

WSS-300 COLOR WIRELESS SURVEILLANCE SYSTEM

FEATURES:

- FCC Approved 2.4GHz Transmitter / Receiver
- Radio w/ Built-In Color Camera / Transmitter
- 380 (H) TVL Resolution • Super Low 2 Lux
- 4-Channel Receiver • 300' Transmission

Note: Cassette Player Non-Functioning \$595

All 985 Series Color Cameras Feature: Superior Resolution - Over 380(H) TV Lines
Super Low 2 Lux Sensitivity, 3.7mm Wide-Angle Lens, Built-In Backlight Compensation

Items May Be Purchased by Credit Card, Certified Check, Money Order or C.O.D.

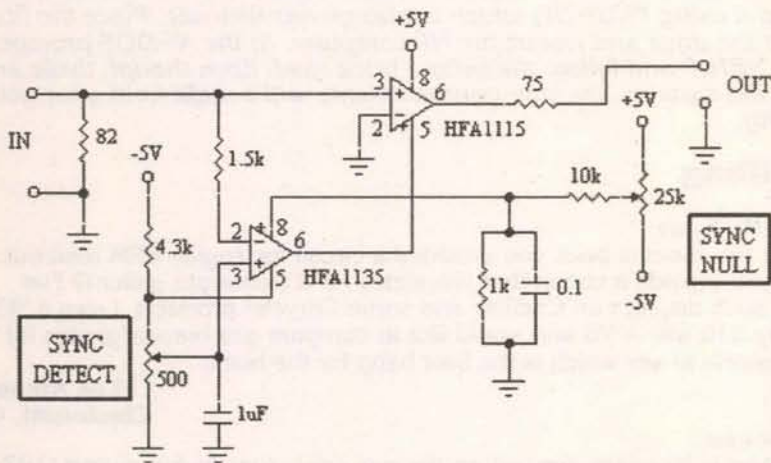
AMERICAN INNOVATIONS, INC.

119 ROCKLAND CENTER - SUITE 315 • NANUET, NY 10954

VOICE: (914) 735-6127 • FAX: (914) 735-3560

[HTTP://WWW.SPYSITE.COM](http://WWW.SPYSITE.COM) • E-MAIL: AMERICAN@SPYSITE.COM

vertical) and a separate vertical sync. The horizontal processor is an LM1391 phase-lock loop (PLL) that separates the horizontal sync from the vertical sync. Finally, the sync signals are removed from the green video using a video sync separator to restore the original green video signal. From there, the signals go to their respective VGA pins. What's missing in this block diagram are the various "glue" components surrounding the LM1881 sync separator and LM1391 PLL chips. You can find the external parts needed for the two chips by downloading their datasheets from National Semiconductor's Web site at <http://www.national.com>. The video sync separator can be made using discrete components; there's a good assortment of sync stripers in the ARRL handbook. For your convenience, here's a simple video sync stripper built around a couple Harris Semiconductor (<http://www.semi.harris.com/>) op amps.



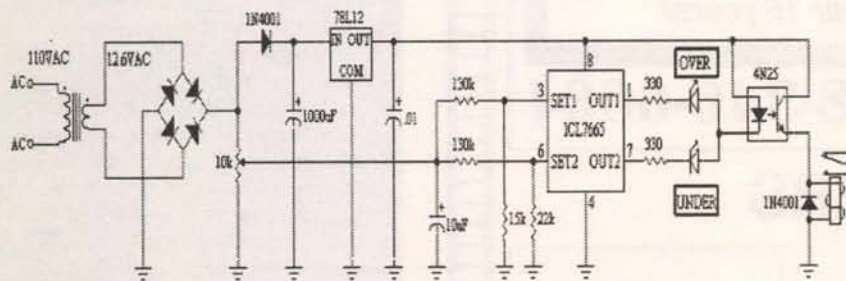
BTW, the LM1881 chip is an industry staple that's cloned by several vendors, including Elantec and Philips. Now let's hope your SVGA monitor has the right capture range to support the HP's scan rates. Can you buy a commercial unit that converts RGB video to VGA video? Not that I can find. Virtually all commercial video converters take the five separate signals, mix them, and output them as composite video.

AC Power Monitor

Q. Hola, I live in Mexico City where we have a lot of AC-line power problems with what you call "brown-out." Sometimes the voltage drops so low that the lights look like a candle, but that's not the worst of it. It plays hell with the refrigerator and my computer. I'd like to know if you've recently published an article that can be used to turn off the power line to the whole house (within 10 seconds) if the line voltage is too high or too low.

Oscar Trejo Rubio
Mexico D.F.

A. Thanks to battery-powered notebook computers, voltage monitoring ICs are plentiful and cheap. The AC-line monitor below is built around an ICL7665 Under/Over Voltage Detector. The chip is made by Harris and Maxim, and is available from Digi-Key (800-344-4539; <http://www.digikey.com>) for \$2.75.



A 12-volt transformer both powers the detector and provides the reference signal. The AC voltage is first rectified. Part of the voltage goes to a 10K pot and is used for the signal, the rest is isolated by a blocking diode (1N4001), filtered, and reduced to 12 volts using a 78L12 voltage regulator; this voltage powers the IC, LEDs and relay. The sensor's over-voltage input is Set1 (pin 3) and the under-voltage input is Set2 (pin 6). The resistors to these two pins are selected so that the IC triggers when the AC line voltage exceeds 125 volts or falls below 90 volts. When the line voltage hits these limits, one or the other LED will light which, in turn, causes the LED in the 4N25 optoisolator to glow and turn on the light-coupled transistor and pull-in the relay. You can use the relay contacts to control other relays (such as a contactor) that will disconnect power to the house. To calibrate the detector, use a Variac to adjust the AC line voltage to 91 volts and turn the 10K pot to the point where the "Under" LED just goes off.

Quality Reconditioned Test Equipment 90 DAY WARRANTY & 10 DAY INSPECTION

HEWLETT PACKARD

10833A/B/C, HPB Cables, 1/2-4 meter	3 for \$50
11730D, Power Sensor Cable, 50 Ft (new)	\$75
1740A, 100 MHz Scope	\$350
1741A, 100 MHz Storage Scope	\$400
180TR, Rack Mount Display	\$200
1980B, Automatic O'Scope Measurement System	\$800
214B, 10 MHz Pulse Generator, 200W Pulse/50 ohms	\$1250
3310B, 5 MHz Function Generator	\$225
3311A, Function Generator, 1 Hz-1 MHz	\$175
3312A, Function Generator, 0.1 Hz-13 MHz	\$550
3325A, 21MHz Synth Function Generator, HPB	\$1650
3325A-2, 21MHz Synth Func Gen, 40Vp-p, HPB	\$2000
33320H, Prog Attn, DC-18GHz, 10dB range, 1dB steps	\$400
33322H, Prog Attn, DC-18GHz, 110dB range, 10dB steps	\$400
3400A, RMS Voltmeter, 10Hz-10MHz	\$150
3403C, Digital RMS Voltmeter, 2 Hz-100 MHz	\$300
3421A-201/44462A, Data Acquisition Control Unit, HPB	\$375
3455A, 6.5 digit Multimeter, HPB	\$350
3456A, 6.5 digit Multimeter, HPB	\$700
3465A, 4.5 digit Multimeter	\$175
3488A, Switch/Control Unit	\$850
3575A, Gain/Phase Meter, 1 Hz-13 MHz	\$700
4274A, 5-1/2 digit LCR Meter, 100Hz-100KHz	\$3400
4275A-01, 5-1/2 digit LCR Meter, 10KHz-10MHz	\$4800
4328A-01, Milliohmeter w/ battery opt	\$1100
432A/478A, Power Meter, 10 MHz-10 GHz	\$225
432A/8478B, Power Meter, 10 MHz-18 GHz	\$325
435A, Power Meter	\$200
436A-022, Power Meter w/ sensor cable, HPB	\$1200
4437A, Step Attenuator, DC-1 GHz, 600 ohm	\$175
44421A, 20 Chan Relay Multiplexer, used on 3497A	\$125
44428A, 16 Chan Actuator/Digital Output, used in 3497A	\$175
44462A/63A, 8 Chan MUX/2 Chan Actuator (3421A)	\$150
44465A, 8 Bit Data I/O (use in 3421A)	\$150
44474A, 16 Bit Data I/O Module, used on 3488A	\$200
44711A, 24 Chan FET Multiplexer, used on 3852A	\$300
491C, Amplifier, 2 GHz-4GHz, 1 Watt, 30dB Gain	\$675
4954A, Protocol Analyzer	\$900
5300A w/5302A, 50 MHz Counter	\$100
5300A w/5303A, 500 MHz Counter	\$200
5314A, 100 MHz Counter	\$175
5316A, 100 MHz Counter, HPB	\$400
5316B, 100MHz Counter, HPB	\$650
5328A, 100 MHz Counter, HPB	\$175
5328A-021-030, 512 MHz Counter w/DVM, HPB	\$400
5328B, 1.3GHz Counter, Oven Osc, DVM, HPB	\$1000
5334A, 100 MHz Counter, HPB	\$650
5334B, 100 MHz Counter, HPB	\$800
5335A-040, 200 MHz Counter, HPB	\$700
5335A-010-030, 1.3GHz Counter, Oven Osc, HPB	\$1200
5342A, Microwave Counter, 18GHz	\$1700
5342A, Microwave Counter, 18GHz, Oven Osc, HPB	\$2000
536A, Frequency Meter, 0.96-4.2 GHz	\$100
5370B, Time Int Counter, 100 MHz, 100 pS accuracy	\$1950
5420A, 500MHz Dig O'Scope, 3.5" Floppy, FFT, HPB	\$4200
54602A, 150MHz Four Channel Digital O'Scope	\$1500
547A, Current Tracer Probe	\$275
6002A-01, Pwr Sup, 200 W, 0-50V @ 0-10A, GPIB	\$675
6034L, Dig Autoranging Pwr Sup, 60V/10A/200W, HPB	\$850
6110A, (Har), Pwr Sup, 0-3KV @ 6mA (cables incl)	\$300
6112A, Precision Pwr Sup, 0-40V @ 0.5A	\$275
6181B, Constant Current Source, 100V, 250 mA	\$300
6227B, Dual Pwr Sup, 0-25V @ 2A	\$475
6253A, Dual Pwr Sup, 0-20V @ 3A	\$350
6255A, Dual Pwr Sup, 0-40V @ 1.5A	\$400
6261B-026, Pwr Sup, 0-20V @ 50A	\$575
6267B, Pwr Sup, 0-40V @ 10A	\$475
6268B, Pwr Sup, 0-40V @ 30A	\$750
6271B, Pwr Sup, 0-60V @ 3A	\$350
6284A, Pwr Sup, 0-20V @ 3A	\$150
6289A, Pwr Sup, 0-40V @ 1.5A	\$150
6291A, Pwr Sup, 0-40V @ 5A	\$400
6294A, Pwr Sup, 0-60V @ 1A	\$150
6433B, Pwr Sup, 0-36V @ 10A	\$400
6515A, (Har), Pwr Sup, 0-1.6KV @ 5mA (cables incl)	\$275
6516A, High Voltage Pwr Sup, 0-3KV @ 5mA	\$375
6827A, Pwr Sup/Amplifier, +/-100V, +/-0.5A, 80dB gain, DC-15 KHz	\$500
8007B, Pulse Generator, 100 MHz	\$450
8084A, Word Generator Plug-In, 300 MHz	\$275
8350A, Sweep Oscillator Mainframe	\$2300
8350B, Sweep Oscillator Mainframe	\$3300
8444A-059, Tracking Generator, 0.5-1500 MHz	\$600
8620C-011, Sweep Oscillator Mainframe, HPB	\$400
86222B, RF Plug-In, 10MHz-2.4GHz	\$1100
86250D, RF Plug-In, 8.0-12.4 GHz	\$375
86290B, RF Plug-In, 2.0-18.6 GHz	\$1400
86602B, RF Plug-In, 1-1300 MHz	\$600
8660C/86631B/86602A, Synth Sig Gen, 1.3 GHz, HPB	\$1800
8901B-1-3, Modulation Analyzer, 150KHz-1300MHz	\$3000
9411B, Automatic Test Station Switch Cont, HPB	\$750

2430A, 150MHz Dig O'Scope, .0015% Time Base, GPIB	\$3400
2465, 300MHz Four Channel Oscilloscope	\$2400
465, 100 MHz Dual Trace Oscilloscope	\$425
475, 200 MHz Dual Trace Oscilloscope	\$650
577D1/177, Storage Curve Tracer w/ std test fixture	\$1700
7104, 1 GHz O'Scope Mainframe	\$1700
7603-1, 100 MHz O'Scope w/ 7A26, 7B53A	\$300
7A13, 105 MHz Differential Comparator	\$150
7A18, 75 MHz Dual Trace Amplifier	\$50
7A22, 1 MHz High CMRR Differential Amplifier	\$200
7A24, 400MHz Dual Trace Amplifier	\$250
7A26, 200 MHz Dual Trace Amplifier	\$75
7B10, 1GHz Delayed Time Base	\$350
7B53A, 100 MHz Dual Time Base	\$75
7B70, 200 MHz Time Base	\$75
7B85, 400 MHz Delta Delaying Time Base	\$100
7B92A, 500 MHz Dual Time Base	\$150
7CT1N, Curve Tracer Plug-In	\$300
7S14, 1 GHz Dual Trace Delayed Sweep Sampler	\$550
AM501, OpAmp (TM500 series) 40V @ 50mA	\$125
AM503, Current Probe Amplifier	\$350
DC5009, 135 MHz Universal Timer/Counter	\$375
DM501, 4.5 Digit Multimeter	\$150
FG502, 11MHz Function Generator	\$200
FG504, 40MHz Function Generator	\$500
P6015, 40kV, 1000X, 75MHz High Voltage Probe	\$250
P6021, Current Probe, 120Hz-60MHz	\$250
P6460, Data Acquisition Probe (for 1240/1241 Analyzer)	\$200
P6602, Temperature Probe	\$125
PS5010, Prog Tripple Pwr Sup, TM5000 series	\$450
PS503A, Tripple Pwr Sup, (2) 0-20 @ 1A, 5V @ 1A	\$150
S-3A, Sampling Head, DC-1 GHz	\$175
S-53, Trigger Recognizer Head (new)	\$250
T922R, 15MHz O'Scope, Front & Rear Inputs	\$375
TG501, Time Mark Generator	\$400
TM5006, 6-slot Programmable Power Module	\$350

MISCELLANEOUS

AEMC SL206, AC/DC Current Probe, 2A & 80A ranges	\$100
AEMC MD400, AC/DC Current Probe, 400A range	\$100
BECO 315A, Universal Impedance Bridge	\$200
Bird 10A, Plug-in Element (Bird 43), 10W @ 25-60 MHz	\$40
Bird 100A, Plug-in Element (Bird 43), 100W @ 25-60 MHz	\$40
Bird 43, Thru-line Wattmeter w/ Leather Case	\$125
Cal Inst 101T/850T, AC Power Source, 0-135VAC, 45Hz-5KHz, 100 Watt	\$650
Cal Inst 251TCA/845T, AC Power Source, 0-135VAC, 250Watt, 45Hz-5KHz, GPIB	\$800
Clarke-Hess 5000, Phase Angle Standard	\$2200
Dranetz 606-3/101-103, Line Disturbance Analyzer	\$300
Dranetz 626, Line Disturbance Analyzer, w/ PA-6002A, PA-6003, PA-6006, cables, and carrying case	\$1100
Ectron 760DLU, Differential Amplifier, DC-50KHz	\$300
EIP 545, Microwave Counter, 10Hz-18GHz	\$1300
EIP 548A-1-2-8-9, Microwave Counter, 10 Hz-26.5 GHz, DAC out, GPIB, rear input, power meter	\$2800
Fluke 5100B-03-05, Meter Calibrator	\$3400
Fluke 5200A, AC Voltage Calibrator	\$1250
Fluke 6010A, Synthesized Func Gen, 10Hz-11MHz, GPIB	\$800
Fluke 8050A-01, 4-1/2 Digit Multimeter w/battery opt	\$175
Fluke 8860, 5.5 Digit Multimeter	\$250
Fluke 8920A, Digital RMS Voltmeter, 10 Hz-20 MHz	\$475
Fluke 8922A, Digital RMS Voltmeter, 2 Hz-11 MHz	\$475
GenRad 1433B, 6-Dec Res, 0-1,111,110 ohms, 0.01%	\$450
Giga-Tronics 900/2-8, Synthesized Sweep/Sig. Gen, 2-8 GHz, opt 026 GPIB	\$1150
Heise 711B, Digital Pressure Gauge, 0 to 30 PSI, .05%	\$475
JC Systems JC520, Temperature Setpoint Programmer	\$200
Keithley 181, 6.5 Digit Nanovoltmeter, GPIB	\$850
Keithley 485, Autoranging Picoammeter	\$400
Keithley 614, Electrometer	\$700
Kepco BOP20-10M, Op Amp/Pwr Sup, +/-20V, +/-10A	\$500
Krohn-Hite 6620, Precision Phasemeter	\$550
Lambda LQ-532, Pwr. Sup., 0-40V @ 5A, Dig Display	\$175
Laser Precision TD-9920, OTDR w/ case & manual	\$575
Narda 3293-2, Directional Coupler, 1-12.4 GHz (N type)	\$150
Narda 4203-16, Directional Coupler, 2-18 GHz (SMA)	\$100
Narda 8616, RF Radiation Monitor w/probes	\$450
Oram Power Supply, 270V @ 10A	\$800
Phoenix 5500-624-1, T1 Interface Plug-in	\$350
PowerDesigns 2020B, Prec Pwr Sup, 0-20V @ 2A, 1mV res	\$150
PowerDesigns 6050C, Multirange Variable Pwr Sup, 0-6V @ 5A, 0-15V @ 3A, 0-30V @ 2A, 0-60V @ 1A	\$200
Simco SS-2X, Electrostatic Locator w/ probe	\$100
Sorensen Pwr Sup, 5V +/-5% @ 200A	\$200
Sorensen DCR150-18B, Pwr Sup, 0-150V @ 18A	\$1250
Sorensen DCR20-115B, Pwr Sup, 0-20V @ 115A	\$800
Valhalla 4440, 4-1/2 Digit Voltmeter / Counter	\$125
Varian VZU6998HS, 12.4-18GHz TWT Amp, 60dB gain	\$2250
Wavetek 154, Prog. Waveform Gen., .001Hz-10MHz	\$100
Wavetek 175, Arbitrary Waveform Generator, GPIB	\$600
Wavetek 186 (rack), 5 MHz Phase Lock Generator	\$250
Wavetek 271-02, 12MHz Pulse/Func Gen, GPIB	\$700

TEKTRONIX

1240, Logic Analyzer w/ (2) P6460 probes	\$1000
2215A, 60MHz O'Scope	\$600
2236, 100MHz Dual Trace O'Scope w/ Counter & DMM	\$1150
2337, 100 MHz O'Scope	\$850

WANTED

Send us a list of your extra catalogs and manuals



TEST EQUIPMENT PLUS
(520) 575-6967, FAX (520) 575-6936
3331 W. Bright Terrace, Tucson, AZ 85741



Summer Specials

MOTHERBOARDS WITH CPU:

Pentium 166 MMX w/ CPU	\$179
Pentium 200 MMX w/ CPU	\$199
Pentium 233 MMX w/ CPU	\$225
AMD K6 233 MMX w/ CPU	\$189
Pentium II 233 MMX w/ CPU	\$355
Pentium II 266 MMX w/ CPU	\$419
Pentium II 300 MMX w/ CPU	\$549
Pentium II 333 MMX w/ CPU	\$669
Pentium II 350 MMX w/ CPU	\$829
Pentium II 400 MMX w/ CPU	\$999

16MB EDO

\$23.95

24X CD ROM....\$59

32X CD ROM....\$69

24X Bundle

\$79

24X Speed CD
16 Bit Sound Card
with Wavetable.

Amplified Speakers 80W

Orders & Price

Tel: (209) 521 5000

Fax: (209) 549 8576

Free Tech Support

1 800 899 6430

Buy with
confidence

Risk Free

30 Days

Money Back

WE ALSO
CARRY
COMPLETE
SYSTEMS

Printer
Memory

For ALL kinds of Drives, Sound Cards
Speakers and CD Titles: \$Call

FLOPPY DRIVES

1.44 Mitsumi.....	\$18
1.44 Teac.....	\$21

MONITORS

14" 28 108 N-I, Low Radiation.....	\$139
15" 28 1024x768 N-I, Low Rad.....	\$175
17" 28 1280x1024 N-I, Low Rad.....	\$309

KEYBOARDS

101 Keyboard.....	\$10.95
Keytronic.....	\$23
Focus 2000.....	\$Call

VGA CARDS

SVGA 1MB ISA.....	\$32
PCI 1MB.....	\$25
PCI 2MB.....	\$35
PCI VGA 4MB.....	\$69
MATROX, ATI, DIAMOND.....	\$CALL
SVGA CARDS WITH VRAM.....	\$CALL
ANY OTHER VGA CARDS.....	\$CALL

CONTROLLER CARDS

I/O 2S, 1P & 1G.....	\$12
----------------------	------

MODEM/ FAX MODEM

33.6K Voice Modem/ Fax Modem.....	\$45
56K Voice Modem/ Fax Modem.....	\$65
US ROBOTIC 56K Modem.....	\$99
ISDN.....	\$CALL

HARD DRIVES SPECIALS

2.5GB..\$149	3.5GB..\$164	4.3GB..\$185
5.4GB..\$199	6.4GB..\$205	8.4GB..\$271

CASES WITH POWER SUPPLIES

MINI TOWER PREMIUM.....	\$35
DESKTOP CASE PREMIUM.....	\$35
MED TOWER CASE PREMIUM.....	\$35
FULL TOWER CASE PREMIUM.....	\$75

IBM 6X86

233MMX

Motherboard

& CPU

\$199

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

200MMX

Faster than Intel

200MHz

\$165

IBM 6X86

DEALER DIRECTORY

The dealers listed below carry the latest issue of Nuts & Volts, for your convenience.

ALABAMA

Little Professor Book Center
2717 S. 18th St.
Birmingham 35209
RT Systems
Amateur Radio Supply
8207 Stephanie Dr.
Huntsville 35802

ARIZONA

Batteries, Batteries
3415 W. Glendale Ave., #4
Phoenix 85051
1829 E. Southern Ave.
Tempe 85282
6245 E. Bell Rd.
Scottsdale 85254
Elliott Electronic Supply
1251 S. Tyndall Ave.
Tucson 85713
Tower Records
3 E. 9th St.
Tempe 85281

AUSTRALIA

DonTronics
P.O. Box 595
29 Ellesmere Cres.
Tullamarine 3043
www.dontronics.com

CALIFORNIA

Abletronics
9155 Archibald Ave., Unit E
Cucamonga 91730
Advanced Computer Products, Inc.
1310 "B" E. Edinger Ave.
Santa Ana 92705
All Electronics
905 S. Vermont Ave.
Los Angeles 90006
14928 Oxnard St.
Van Nuys 91411
Allen's To Go
13461 Hwy. 88
Lockeford 95237
Alltronics
2300-D Zanker Rd.
San Jose 95131
Brand Newsstand
234-1/2 N. Brand Blvd.
Glendale 91203
Centerfold International
716 N. Fairfax Ave.
Los Angeles 90046
Del Amo Books & News
3758 Sepulveda Blvd.
Torrance 90505
Digicity.Net
4549 Quail Lakes Dr.
Stockton 95207
Electro Mavin
2985 E. Harcourt St.
Rancho Dominguez 90221
Ford Electronics
8431 Commonwealth Ave.
Buena Park 90621
Harding Way News
113 W. Harding Way
Stockton 95204
Harold's Newsstand
524 Geary St.
San Francisco 94102
HdB Electronics
2860 Spring St.
Redwood City 94063
Hi-Fi Doctor
1814 E. Ball Rd.
Anaheim 92805
HSC Electronic Supply
4837 Amber Ln.
Sacramento 95841
3500 Ryder St.
Santa Clara 95051
5681 Redwood Dr.
Rohnert Park 94928
JK Electronics
6395 Westminster Ave.
Westminster 92683
Laurel Park News
4346 Laurel Canyon Blvd.
Studio City 91604

Lion Electronic Labs

4948 E. Townsend Ave.
Fresno 93727
NetSeller
7207 Arlington Ave. Ste. G
Riverside 92503
Op Amp Technical Books
1033 N. Sycamore Ave.
Los Angeles 90038
Pace Electronics
369 Hampshire Rd.
Thousand Oaks 91361
Panorama Electronics
8737 Van Nuys Blvd.
Panorama City 91402
Porter Ranch News Stand
18473 Devonshire St.
Northridge 91325
Quality Time Computers
10331 De Soto Ave.
Chatsworth 91311
Sandy's Electronics Supply, Inc.
20655 Soledad Cyn. Rd. #15
Santa Clarita 91351
Sav-On Electronics
13225 Harbor Blvd.
Garden Grove 92643
Short Circuits
36-660 Bankside Dr. #F
Cathedral City 92234
Speakerworld Technology
2000 Warm Springs Ct. #6
Fremont 94539
Springbok News
55 N. Baldwin Ave.
Sierra Madre 91024
Tower Books
211 Main St.
Chico 95928
7840 Macy Plaza Dr.
Citrus Heights 95610
1280 E. Willow Pass Rd.
Concord 94520
630 San Antonio Rd.
Mountain View 94040
1600 Broadway
Sacramento 95818
5950 Florin Rd.
Sacramento 95823
2538 Watt Ave.
Sacramento 95812
2727 El Camino Real
San Mateo 94403
Tower Magazines/News
885 Riverside Pkwy.
West Sacramento 95605
Tower Records/Video
220 N. Beach Blvd.
Anaheim 92801
2520 Durant
Berkeley 94704
212 F St.
Davis 95616
5703 Christie Ave.
Emeryville 94608
5611 Blackstone
Fresno 93710
2052 Redwood Hwy.
Greenbrae 94904
6310 E. Pacific Coast Hwy.
Long Beach 90803
2280 Market St.
San Francisco 94114
3205 20th Ave.
San Francisco 94132
2525 Jones St.
San Francisco 94133
871 Blossom Hill Rd.
San Jose 95123
14570 Ventura Blvd.
Sherman Oaks 91403
1205 W. Covina Pkwy.
West Covina 91790
Valencia Newsstand
23164 W. Valencia Blvd.
Valencia 91355
Video Electronics
3829 University Ave.
San Diego 92105

CANADA

Com-West Radio Systems Ltd.
48 E. 69th Ave.
Vancouver, BC V5X 4K6
Muir Communications Ltd.
3214 Douglas St.
Victoria, BC V8Z 3K6
Norlink Communications & Consulting
428 E. Victoria Ave.
Thunder Bay, Ontario P7C 1A5

COLOMBIA

Roboli-K
Carrera 38 No. 10-60,
Local 258, Bogota
COLORADO
Fistell's Micro Electronics
7023 E. Colfax Ave.
Denver 80220
International Tesla Society
2220 E. Bijou St.
Colorado Springs 80909
Tower Records/Video
2500 E. 1st Ave.
Denver 80206
Western Test Systems
530 Compton #C
Broomfield 80020

CONNECTICUT

Archway News
64 Bank St.
New Milford 06776
Deric Electronics
1660 Whitney Ave.
Hamden 06517
DELAWARE
Newark Newsstand
70 E. Main St.
Newark 19711

DISTRICT OF COLUMBIA

Tower Records
2000 Pennsylvania Ave.
Washington 20006

FLORIDA

Alfa Electronic Supply
1502 S. St. Rd. #7
Hollywood 33023
Bob's News & Books
1515 S. Andrew Ave.
Fort Lauderdale 33316
Clarks Out of Town News
303 S. Andrews Ave.
Fort Lauderdale 33301
Mike's Electronic Distributing Co.
1001 N.W. 52nd St.
Fort Lauderdale 33309
Skycraft Parts & Surplus, Inc.
2245 W. Fairbanks
Winter Park 32789
Sunny's At Sunset, Inc.
8260 Sunset Strip
Sunrise 33322

GEORGIA

Tower Records
3400 Around Lenox Dr.
Atlanta 30326

HAWAII

SolarWorks!
525 Lotus Blossom Ln.
Ocean View 96737
Tower Records
4211 Wai'alae Ave.
Honolulu 96816
611 Keeaumoku
Honolulu 96814

IDAHO

The Current Source
5159 Glenwood
Boise 83714

ILLINOIS

City Newsstand
4018 N. Cicero
Chicago 60641

Pick's Electronics
Lewis Park Mall
Carbondale 62901
Tower Records/Video/Books
383 W. Army Trail Rd.
Bloomington 60108
2301 N. Clark St. #200
Chicago 60614
1209 E. Golf Rd.
Schaumburg 60173

INDIANA

Harbourtown Sales
108 Park 32 W. Dr.
Noblesville 46060

KANSAS

Hollywood At Home
9063 Metcalf Ave.
Overland Park 66212
Lloyd's Radio & Electronic, Inc.
220 W. Harry St.
Wichita 67213

LOUISIANA

Lakeside News
3323 Severn Ave.
Metairie 70002
Tower Records
408 N. Peter St.
New Orleans 70130

MARYLAND

Silicon Valley Electronics
2014-A Industrial Dr.
Annapolis 21401
Tower Records/Video
2566 Solomons Island Rd.
Annapolis 21401
1601 Rockville Pike #210
Rockville 20852

MASSACHUSETTS

Full Spectrum Communications
244 Essex St.
Salem 01970
Newsbreak, Inc.
579 G.A.R. Hwy. Rt. 6
Swansea 02777
Tower Records #172
360 Newbury St.
Boston 02115

MICHIGAN

Family Electronics
111 E. Superior St.
Alma 48801
Little Professors Book Center
22174 Michigan Ave.
Dearborn 48124
MW Electronics
229 E. Michigan Ave.
Paw Paw 49079
Purchase Radio Supply, Inc.
327 E. Hoover Ave.
Ann Arbor 48104

Tower Records

1214 S. University Ave.
Ann Arbor 48104

MINNESOTA

Radio City, Inc.
2633 County Road 1
Mounds View 55112

MISSOURI

Accurate Instruments
11201 E. 24 Hwy.
Independence 64054
Electronics Exchange
8644 St. Charles Rock Rd.
St. Louis 63114

NEVADA

Amateur Electronic Supply
1072 N. Rancho Dr.
Las Vegas 89106
Less Buster's Electronics
2930 N. Las Vegas Blvd.
VSTG-22
North Las Vegas 89030
Radio World
1656 Nevada Hwy.
Boulder City 89005

Tower Records/Video
4580 W. Sahara Ave.
Las Vegas 89102
6450 S. Virginia
Reno 89511

NEW JERSEY

Sys-Com
707 22nd St.
Union City 07087
JR Tech Systems
1309 Hwy. 71
Belmar 07719

NEW YORK

All Phase Video Security, Inc.
70 Cain Dr.
Brentwood 11717
Global News, Inc.
22 8th Ave.
New York, NY 10016
Ham Central
3 Neptune Rd.
Poughkeepsie 12601
Hirsch Sales Corporation
219 California Dr.
Williamsville 14221
Hi-Tech Repair, Inc.
270 Neelytown Rd.
Montgomery 12549
Tower Records/Video
105 Old Country Rd.
Carle Place 11514
350-370 Route 110
Huntington 11746
1961 Broadway
New York 10023
383 Lafayette St.
New York 10003

OHIO

Compustuff
241 Great Oaks Trl.
Wadsworth 44281
Digital One
7603 Mentor Ave.
Mentor 44060
Footsteps
4925 Jackman Rd. Store #58
Toledo 43613
Hosfelt Electronics, Inc.
2700 Sunset Blvd.
Steubenville 43952
Keyways, Inc.
611 S. Main St.
Miamisburg 45342
Leo's Book Shop
330 N. Superior St.
Toledo 43604
Powermass, Inc.
1587 U.S. Route 68 N.
Xenia 45385

OKLAHOMA

Steve's Books & Magazines
2612 S. Harvard
Tulsa 74114

OREGON

News & Smokes
2295 W. Main St.
Medford 97501
News & Smokes #8
259-C Barnett Rd.
Medford 97501
Norvac Electronics
7940 SW Nimbus Ave. Bldg. 8
Beaverton 97005
960 Conger
Eugene 97402
1545 N. Commercial NE
Salem 97303
Powell's Technical Bookstore
33 NW Park
Portland 97209
Tower Books
1307 NE 102nd Ave.
Portland 97220
PENNSYLVANIA
Business & Computer Bookstores
213 N. Easton Rd.
Willow Grove 19090

Lehman Scientific
2997-F Cape Horn Rd.
Red Lion 17356
Monico Electronics & Computers
2555 Industry Ln. Ste. D
Norristown 19403

Penn Electronics

2310 A Walnut St.
Harrisburg 17103
Surplus AI
RR 1 Box 337
Hunlock Creek 18621

Tower Books

425 South St.
Philadelphia 19147
Tower Records
340 W. Dekalb Pike
King of Prussia 19406

SOUTH CAROLINA

555 Electronics
5646 Farrow Rd.
Columbia 29203

TENNESSEE

Tower Books
204 W. End Ave.
Nashville 37203

TEXAS

BDL News, Inc.
809 Pierce
Houston 77002
Electronic Parts Outlet
3753-B Fondren Rd.
Houston 77063
Tanner Electronics
1301 W. Beltline #105
Carrollton 75006
Tower Records
2403 Guadalupe
Austin 78705

VIRGINIA

Satellite Headquarters
7920 Timberlake Rd.
Lynchburg 24502
Tower Records/Video/Books
6200 Little River Tpk.
Alexandria 22312
4110 W. Ox Rd. #12124
Fairfax 22033
1601 Willow Lawn Dr.
Richmond 23230
8389 E. Leesburg Pike
Vienna 22182

WASHINGTON

A-B-C Communications, Inc.
17541 15th Ave. NE
Seattle 98155

Bohica Concepts

214 2nd St.
Morton 98356

Cody Books Ltd.

1122 Fir Ave.
Blaine 98230

Superfronix

18650 68th Ave. S.
Kent 98032

Tower Books

10635 NE 8th St.
Bellevue 98004

20 Mercer St.

Seattle 98109

WISCONSIN

Amateur Electronic Supply, Inc.
5710 W. Good Hope Rd.
Milwaukee 53223
Greenfield News & Hobby
6815 W. Layton Ave.
Greenfield 53220
News & Hobby Center
4758 Packard Ave.
Cudahy 53110

AMATEUR ROBOTICS

NOTEBOOK

by Robert Nansel

Welcome to the Amateur Robotics Notebook — the first of a series of articles on low-cost tools, materials, and techniques useful in the robotic art.

Homebrew robots have been my passion for over 25 years. I've been a member of the Seattle Robotics Society since '84, and edited their newsletter from '91 to '94, though now I live in Pittsburgh.

Over the years, I've traveled all over North America giving talks on robotics to groups in British Columbia, Massachusetts, Connecticut, Georgia, Ontario,

their own ways, and have taught me much.

My philosophy

I want to emphasize tools, materials, and components that are inexpensive and widely available — from multiple sources where possible — so everybody can duplicate projects I present. I'll use surplus components on occasion, but only when they are also available outside of surplus channels (my budget is not unlimited, after all). Finally, so I won't leave out folks who *don't* breathe solder smoke as a sacrament, I want to point toward robot

absolute minimum outlay of time and money.

Let's get started on the mechanics.

Preparing the breadboard

Breadbot's chassis and main circuit board are made from a modified solderless breadboard. The particular breadboard I used is the GSP GB2-120, available from Future/Active Electronics. This breadboard measures 6.5" long by 2.16" wide. Serendipitously, this width is a perfect fit for mounting two Futaba S148 servos laying side-by-side, and it also matches the

knife to cut through the backing paper and double-sticky foam, and scrape the foam and adhesive away. You should now see the ends of the first two rows of metal contacts and a hole between them molded in the plastic (Figure 1).

With a 5/64" bit, drill the hole the rest of the way through the board. The exit hole should end up perfectly centered in the groove that runs the length of the component side. Check that the 0.075" music wire can turn freely in this hole. Cut a 5/16" square of 1/32" thick scrap plastic to fit in the gap you've made in the double-sticky foam (plastic bread wrapper clips

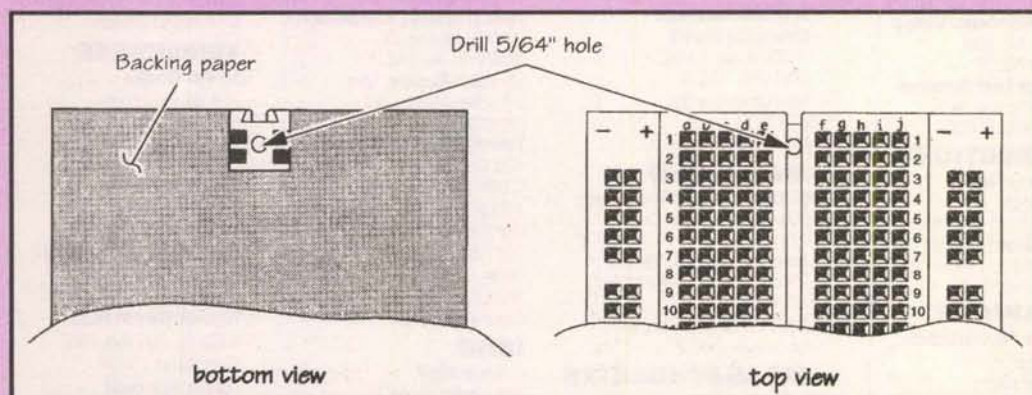


Figure 1. Breadboard modifications.

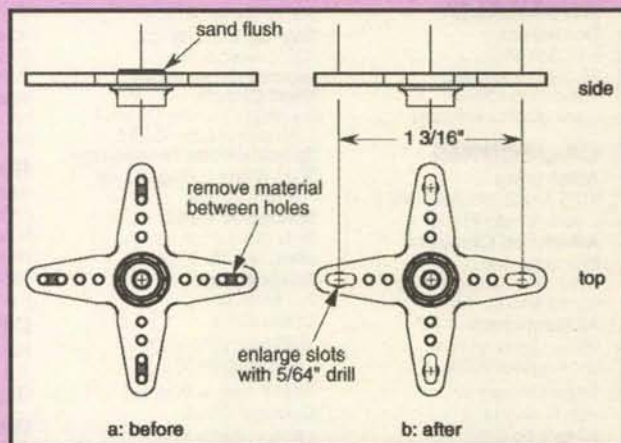


Figure 2. Servo control horn modifications.

Texas, Northern and Southern California, Oregon, and Washington state. I've attended robotics competitions: robot sumo tournaments, the BEAM Robot Olympics, the Trinity Robot Firefighting Contest, and others, too numerous to mention.

It takes a village ...

The most important thing I've learned about robots and those who build them is the need for a community. Just as it takes a village to raise a child, it takes a community sharing resources to build working robots. Robotics is inherently a multi-disciplinary art, the confluence of esthetics, sensing, motion, and computing, and no one person can hope to master every field involved in it. Despite this, I've met quite a few fellow gearheads who share my passion for (and frustration with) these cybernetic creatures. Many of these folks have mastered enough parts of the disparate disciplines that they build robots that fly, swim, climb, hop, burrow, and — occasionally — make accurate 90-degree turns in a maze. These people have all advanced the Robotic Arts in

kits and modules. There are new companies with robot kits appearing every day; several advertise in this magazine.

The village of robot builders is still small, but we are well-networked and, together, we will do amazing things.

Breadbot — a minimalist table-top robot

Overview

Breadbot is a simple, easily customizable robot that will serve in this initial series of articles as a platform for experiments in basic robot control, sensing, and navigation. It uses readily available, low-cost components. Also, because of its low cost and simplicity, it is ideal for construction by students in a classroom environment.

In its simplest version, Breadbot uses the Parallax BASIC Stamp as its on-board controller, but it is not limited to the BASIC Stamp. Any microcontroller that can be plugged into a solderless breadboard is a candidate for a Breadbot controller. I use the BASIC Stamp first, though, to get the Breadbot rolling with the

length of a four AA-cell battery holder, the kind where all four batteries lay flat in a row.

The breadboard is really three pieces: a single 630-tiepoint terminal strip combined with two 100-tiepoint bus strips, one on each side. All three pieces are held together by molded-in dovetails on the sides and a sheet of double-sticky foam on the bottom. It is this double-sticky foam that makes building Breadbot so easy; you just cut and peel away portions of the backing paper and stick the battery holder and the servos in place. The GSP even has molded-in mounting bosses, one of which is used for mounting the trailing caster wheel. What could be simpler?

The first step is to drill a hole through the breadboard for the caster strut. Locate the end of the breadboard with the dovetail slot (for the GSP breadboard, this is the end where the first row of tie points is marked "1" on the component side). This end will be the rear of the robot. On the backing paper on the bottom side, mark in pencil a 5/16" square centered and flush with this end, then use a hobby

knife to cut through the backing paper and double-sticky foam, and scrape the foam and adhesive away. You should now see the ends of the first two rows of metal contacts and a hole between them molded in the plastic (Figure 1).

With a 5/64" bit, drill the hole the rest of the way through the board. The exit hole should end up perfectly centered in the groove that runs the length of the component side. Check that the 0.075" music wire can turn freely in this hole. Cut a 5/16" square of 1/32" thick scrap plastic to fit in the gap you've made in the double-sticky foam (plastic bread wrapper clips

are ideal for this), then mark and drill a hole to match the one in the breadboard. This square of plastic will serve to insulate the contacts from the metal shaft collar of the caster assembly.

Mounting the servos and battery holder

Before you mount the servos, you must first modify them for continuous rotation. This procedure, as well as other basics of robotics, is explained very well in the Seattle Robotics Society webpage. If you are unfamiliar with modifying ser-

vos, I urge you to take a look at the SRS webpage before proceeding: <http://www.seattlerobotics.org/guide/>.

Peel away the portions of the backing paper you cut in the previous step to expose the sticky foam, the sections between the 0.5" and 2.125", and the 3.0" and 5.5" marker lines. Leave in place the strips of backing paper in between (on the ends and in the middle). These covered sections of sticky foam will be used for attaching sensors and what-not in the future.

Mount your modified servos in the orientation shown in Photo 3. Take care that the mounting tabs of the servos line up with the edge of the breadboard (see Photo 7). With the measurements given, the shafts of both servos will be about 1.75" from the front end of the breadboard. To make the servos more secure, place a strip of cellophane tape across them.

Mount the battery holder with its power leads facing what will be the left side of the robot. Now is a good time to neaten up the servo cables and power leads with a few nylon cable ties; leave about 2.5" free on the ends of the cables so you can route them up around to the component side. The female servo connectors each mate with three-pin strip-line headers plugged into the breadboard; for the time being, the tinned wire ends of the power leads plug directly into the left-side distribution busses, so to remove power from the board you pull the power lead out.

Mounting the wheels

I used the four-arm, 1-1/2" control horns that come with S148 servos to mount the wheels. Both the Futaba control horns and the 2-1/4" Stream Line wheels must be modified to fit each other.

First, the control horns: sand off the ribbed hub ring that protrudes above the top side of the control horn (the side with the numbers on it). This hub ring only sticks up about 1/64", but since it's a larger diameter than the hub hole in the wheel, it must be removed so the control horn will lie flush with the wheel disk (Figure 2a).

With a hobby knife and a needle file, remove the plastic between the two outermost holes on each control arm (Figure 2b). The idea is to make slots to match up with the four screw holes of the wheel disks. At first, make the slots slightly narrower than the 2-56 screws (you will enlarge them in a later step).

Now for the wheels: The Stream Line wheel consists of two snap-together, injection-molded plastic wheel disks that sandwich a rubber O-ring tire. The inboard disk has

four hollow pins that mate with corresponding holes on the outboard disk (I use the terms "inboard" and "outboard" meaning facing either toward or away from the robot,

bit, ream out the four screw holes in each wheel disk (this operation is best done with a drill press, but you can use a hand drill if you are careful). Insert 2-56x1/2" flathead

flush. Remove the screws, and set aside.

Do a jig

The final step is to mate the wheels to the control horns. You will need to ream the slots you made earlier with a 5/64" drill bit so the screws will go through the slots (Figure 2b), but getting the slots aligned with the holes in the wheel disks can be a bit tricky.

You can eyeball it, but I found a better way is to use a quarter-inch 4-40 threaded spacer as a temporary jig to hold everything in alignment while you drill the slots out. The hub of the wheel disk is just the right size to fit a 1/4" round aluminum spacer, and a 4-40 machine screw fits the screw hole in the control horn hub. Place the inboard disk on a flat surface, hollow pins up, and press the spacer into the

wheel hub. The fit will be very snug, and if you have any trouble, try chamfering the rim of the hub with a hobby knife to remove any plastic flash. Push the spacer in until it is even with the outer surface of the disk. If it protrudes beyond the outer surface, press it back flush.

Now place the control horn with its sanded side against the outer surface of the wheel disk, center the hubs, and secure the control horn to the spacer with a round head 4-40 screw. If the head of the screw is too large to fit in the splined hub of the control horn, use a washer larger than the hub to keep the screwhead on top of the hub. Don't force the screwhead to fit in the hole, or you risk stripping the splines and rendering the control horn unable to mate with the servo shaft. Finger-tighten the screw, then turn the control horn until its four slots align with the four holes in the wheel disk.

Sighting through the hollow pins from the wheel disk side will help you get the alignment perfect; when everything is aligned, tighten the screw. Drill the first slot out with the 5/64" bit and place one of the 2-56 screws through the newly enlarged slot to ensure everything stays aligned while you drill out the next three. Repeat for the second wheel and control horn. It's a good idea to use a permanent marker to designate which control horn goes with which wheel; also mark the first hole you drill on both pieces so you can later re-assemble them in the same orientation.

When you're done, you can unscrew everything, and pull out the aluminum spacer.

Congratulations: you've just-converted ordinary control horns into precision wheel mounts.

Now, put the wheels together

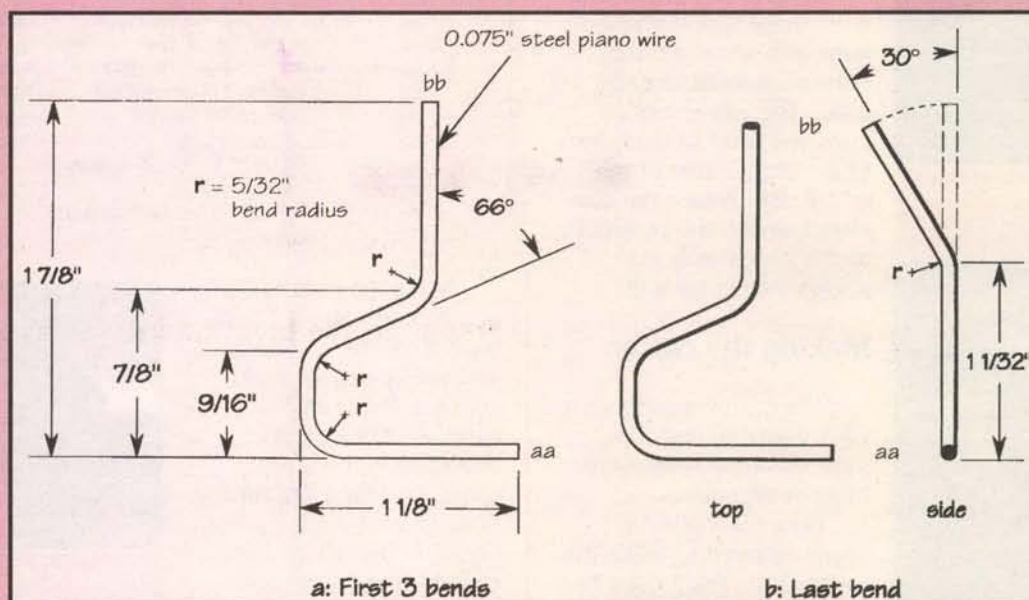


Figure 3. Making the caster strut.

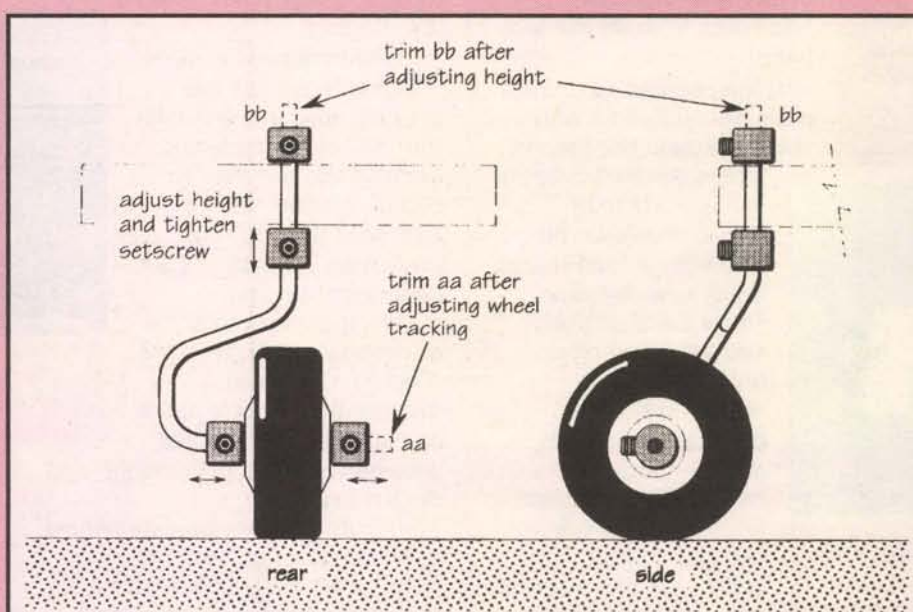


Figure 4. Adjusting caster tracking and height.

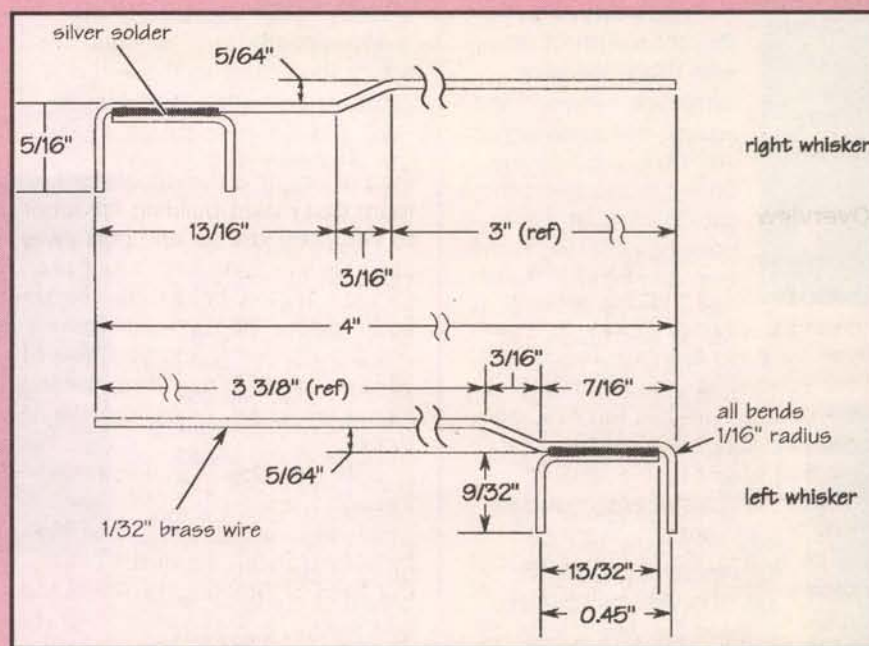


Figure 5. Fabricating the whiskers.

respectively). Snap the wheel disks together without their tires, and mark both halves of each with "L" and "R," respectively. With a 5/64"

machine screws through the holes to check the fit. You may need to countersink the holes in the outboard disks so the screw heads lie

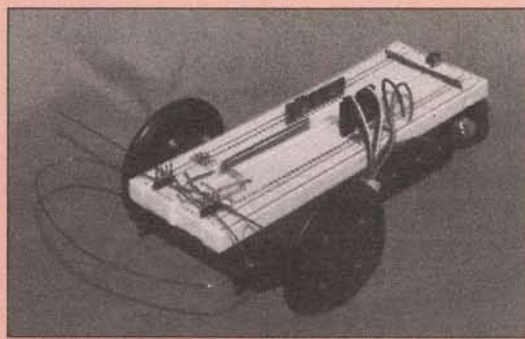


Photo 1. Breadbot with "bow tie" front bumper and side whiskers.

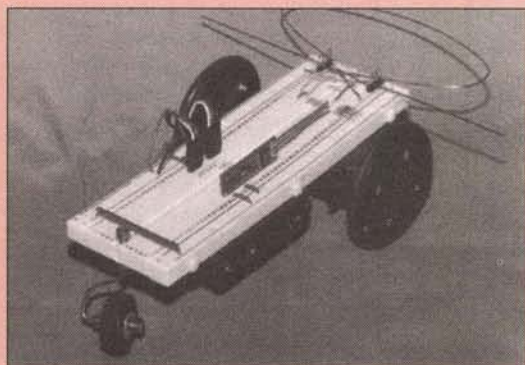


Photo 2. Reverse angle shot. Notice the jumper wires tying together the left and right power and ground distribution busses; both jumpers must be far enough forward that the setscrew in the top shaft collar can clear the jumpers when the caster turns.

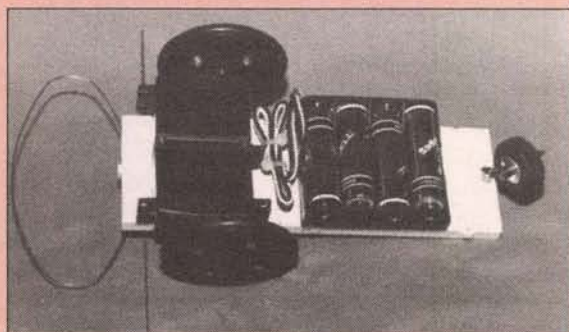


Photo 3. Breadbot's underside. I used nylon cable ties to hold the servo cables neatly in place between the battery holder and the servos.

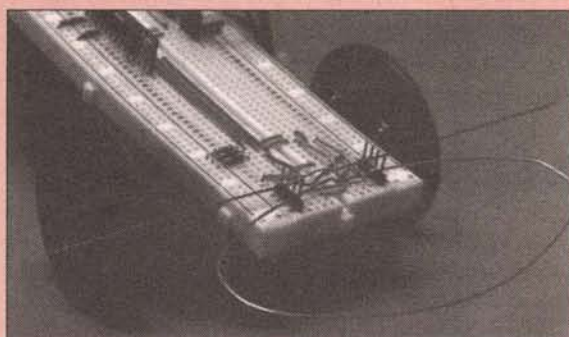


Photo 4. Close-up of Breadbot's whiskers and "bow tie" bumper.

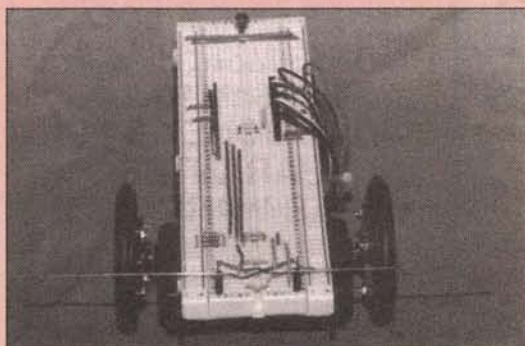


Photo 5. View of Breadbot with "bow tie" bumper removed.

with their tires, and attach their respective wheel mounts with the 2-56 screws and hex nuts (Photo 7).

When you tighten the nuts, make sure the wheel hubs and wheel mounts remain centered to each other. The wheel mount arms will bend to conform to the slight curve of the wheel disk. Attach the completed wheel/hub assemblies to the servos with the screws they come with.

Making the caster

The caster consists of a strut, a wheel, and four shaft collars to hold everything in alignment.

Figure 3 shows the bends required to make the caster strut. You'll need two pairs of pliers and a bending jig to make the first three bends, and pliers and a bench vise to make the last bend.

The bending jig is just a piece of two-by-four with two #18 round head wood screws screwed in about half an inch apart. The screws should be the kind with an unthreaded shank near the head. Screw them vertically into the wood block until there is just enough clearance between their heads and the block to slide in the 0.075" music wire.

With the block clamped to your workbench, use one screw as a brace and the other as a post to bend the wire around.

Begin with a 12" straight length of music wire. Place the wire diagonally between and against the screw posts and mark a pencil line on the wood along the wire starting at the bending post; this is the zero degree line. Then use a protractor to mark off 66 and 90 degrees on the wood block relative to the zero line, and draw tangent lines from the bending post to the angle marks.

In the middle of the wire, make the first 66-degree bend (see Figure 3a). You will actually need to bend the wire a little further than the mark because it will spring back some when you let go; bend it just enough past the mark so that when it springs back it lines up with the line.

Quan.	Unit	Description	Vender	P/N
1	ea.	1" tail wheel	Tower Hobbies	GPMQ4241
4	ea.	1/16" wheel collars	Tower Hobbies	GPMQ4300
2	ea.	Futaba S148 servos, modified (see text)	Tower Hobbies	FUTM0710
12	in.	0.075" dia. music wire	(local hobby shop)	
24	in.	1/32" dia. brass wire	(local hobby shop)	
1	ea.	BASIC Stamp I module	Parallax	BS1-IC
2	ea.	Stream Line 2 1/4" wheels	NW Model Dist.	NWM100BLACK
1	ea.	4 AA-cell batt. holder	Radio Shack	270-391
3	ea.	1 Kohm, 1/4W resistor	Radio Shack	271-1321
1	ea.	36-pin male header	Digi-Key	929647-02-36-ND
1	ea.	GSP breadboard	Future/Active	GB2-120
8	ea.	2-56 1/2" flathead screws		
8	ea.	2-56 hex nuts		
1	ea.	5/16"x5/16"x1/32" plastic (see text)		

Make the second 66-degree bend about 11/32" away from the first bend, and the 90-degree bend about 9/16" from that bend. All three bends should lie in the same plane. Compare the dimensions of your work against Figure 3. Don't trim the ends to length until you have the angles and dimensions correct. You may have to try a couple times to get it just right.

The final bend is made with the "hook" of the strut clamped in a vise with the "bb" end vertical and pointing up, and the "aa" end of the hook pointing left. Bend the "bb" end away from you until it's 30 degrees off vertical.

It's important to come as close to the shape in the drawing as you can because there is only about an eighth of an inch clearance between the caster wheel and the battery holder.

Figure 4 shows how the wheel is held in place on the strut. The 1/16" shaft collar holes first have to be drilled out to 5/64" (don't forget to remove the setscrews before drilling!). Slide the collars and the caster wheel onto the music wire shaft at "aa," and adjust the collars so the wheel is centered with the caster spindle "bb" and is free to rotate. I align the setscrews so they all face the same direction for ease of setup.

Next, slide a shaft collar and the 5/16" plastic square (remember?) onto the caster spindle and loosely tighten the collar. Slip the whole assembly up into the hole in the breadboard and install the final shaft collar on top. Adjust the bottom collar up or down until the breadbot chassis is level, and tighten it in place, then adjust and tighten the top collar so that the caster wheel assembly is free to rotate 360 degrees. Check especially that the wheel clears the rear edge of the

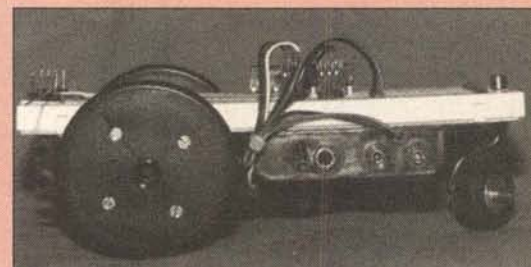


Photo 6. Side view showing the battery holder. Another cable tie secures the battery holder wires to the servo cables.

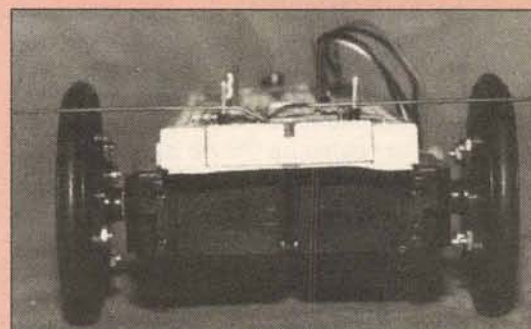


Photo 7. Head-on close-up of servos and whiskers ("bow tie" bumper removed for clarity).

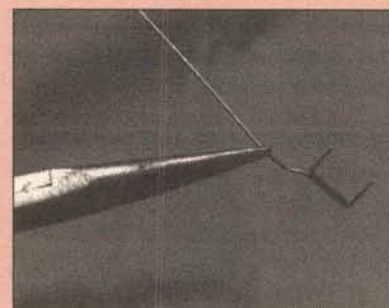


Photo 8. Close-up of the left whisker.

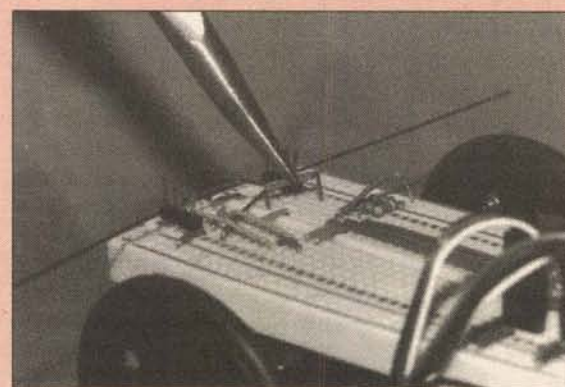


Photo 9. Installing the left whisker. The jumper wire visible to the right of the whisker is shown unconnected; in its final position, it lays over the left whisker lead to connect to the strip-line header for the right whisker.

battery holder when batteries are in place.

Suppliers Mentioned:

Digi-Key Corp.

701 Brooks Ave. South
Thief River Falls, MN 56701-0677
1-800-344-4539
<http://www.digikey.com>

Future/Active Electronics

Dept. FAC 4
41 Main St.
Bolton, MA 0170
1-800-655-0006

Northwest Model Distributing

21527 N.E. 227th Ave.
Battleground, WA 98604
1-360-687-9452

Parallax, Inc.

3805 Atherton Road #102
Rocklin, CA 95765
1-888-512-1024
<http://www.parallaxinc.com>

Radio Shack

1-800-THE-SHACK
<http://www.radioshack.com>

Tower Hobbies

P.O. Box 9078
Champaign, IL 61826-9078
1-800-637-4989
<http://www.towerhobbies.com/>

Fabricating the whiskers

I'll finish off with more wire bending, this time for the left and right whisker sensors (the "bow tie" bumper will have to wait until next month). Fortunately, bending 1/32" brass wire is much easier than bending music wire.

Breadbot's whiskers solve the tricky engineering problem of how to make a cheap, sensitive, yet reliable bumper contact sensor. Usually this sort of thing is done with microswitches, which cost several dollars each, but these whiskers will cost only pennies to make.

The whiskers are designed to plug directly into the breadboard where they are connected to ground (see Photo 9). Each whisker is situated between the two rear-most pins of a four-pin header.

These pins serve both as mechanical stops and electrical contacts; their associated pull-up resistors are the only electronic parts on the breadboard aside from the BASIC Stamp controller. When a whisker touches something and deflects, contact is made, and the

pin is pulled low, signalling the controller that the whisker has sensed an obstacle. The "bow tie" bumper works in a similar fashion, though it uses the front two pins of the four-pin headers for its contacts.

Start by cutting two 6" and two 1" lengths of 1/32" brass wire. Bend the two 1" lengths into 90-degree L-shapes as shown in Figure 5. Leave them untrimmed for the time being.

For the 6" pieces, make the 90-degree bends first (leave at least 1/8" extra on the tails), and make the rest of the bends to match Figure 5. All of these bends should be coplanar.

Now trim the L-shapes so that when you solder them to the whiskers the pins are separated by 0.45" (this is the approximate diagonal distance between holes on the breadboard, two holes down, and four across).

Now comes soldering. Onto a piece of scrap wood, tape the L-shapes and the whiskers in the orientation shown in Figure 5. Dab the joint with a little rosin paste flux (not acid flux), and solder with silver solder to make nice strong joints. After the joints cool enough to handle, flip them over and repeat the process if needed to get a smooth joint. Trim the leads to their finished dimensions.

With the whiskers in the orientation shown, the final bends are made up from the figure. Make the bends (about 27 degrees) 13/16" from the ends with the solder joints. The headers plug into the last four rows of contacts (columns "a" and "f," rows 60-63, on the GSP board); the right whisker plugs into f-59 and j-57, and the left whisker plugs into a-57 and e-59. Adjust the bends until both whiskers are centered between their respective header pins and are horizontal and square with the breadboard.

Next time

Well, I'm out of space. Next month, I'll finish up the mechanical details of Breadbot and show how to install the brain and program it. I'll also give some higher-performance alternatives to the BASIC Stamp controller. **NV**

Other breadboards than the GSP should also work fine to make a Breadbot. The Jameco JE23 (#20722) should work, as should the JDR PDS70 when combined with two PSD30 distribution strips. I haven't used either of these, but from catalog photos they appear to be the same breadboard. Just be sure they come with double-sticky foam on the underside, or be prepared to provide your own.

One commonly available breadboard that won't work as well, though, is the Radio Shack breadboard (#276-174). Its dimensions are different (it's shorter), it doesn't come with double-sticky foam, and it has only a single distribution bus on each side, which makes wiring more complicated. In contrast, the GSP breadboard has two distribution busses on each bus strip. Then, too, the GSP has the molded-in mounting boss for mounting the trailing caster wheel.

I may build a version of Breadbot using the Radio Shack breadboard in the future because it has the advantage that Radio Shack also carries a matching PCB that would allow me to directly transfer the design from the solderless breadboard to the PCB for a more permanent 'bot. This would be really handy for making a fleet of these machines to investigate group behavior among robots, and it would save money, too, since the PCBs cost \$2.99 each — one-third the cost of the solderless breadboards.

Celebrating our 16th Year Of Service !!

COLLIMATING LENS

This economical collimating lens assembly consists of a black anodized aluminum barrel that acts as a heat sink, and a glass lens with a focal point of 7.5mm. Designed to fit standard 9mm laser diodes. Simply place diode in the lens assembly, adjust beam to desired focus, then set with adhesive.

STOCK#	1-9	10-24	25+
LSLENS Lens Assembly	24.99	23.74	21.37

DIODE/TRANSISTOR TESTER KIT

This dynamic tester allows checking of transistors & diodes in circuit. Identifies NPN or PNP transistors. Checks all types, small or large power. Identifies anode or cathode of diodes.

STOCK#	1-9	10-24	25+
DT100K	24.99	23.74	21.37

ANTI-STATIC FOAM CLEANER

A thick, foaming cleaner for use in static sensitive applications. Safe for plastics and fiberglass. Use on computer cases and all office equipment. Also cleans soft fabrics. 5 oz. aerosol can.

STOCK#	1-9	10-24	25+
SB1102	1.99	1.89	1.70

EPROMS

STOCK#	1-24	25-99	100+
2716	2.99	2.84	2.56
2732	4.49	4.27	3.84
2732A-20	5.39	5.12	4.61
2764-20	5.39	5.12	4.61
2764-25	4.49	4.27	3.84
2764A-20	3.49	3.32	2.99
2764A-25	2.99	2.84	2.56
27C64-15	2.99	2.84	2.56
27256-15	4.79	4.55	4.10
27C256-15	2.99	2.84	2.56
27512-25	3.09	2.94	2.65
27C512-25	2.99	2.84	2.56
27C010-15	3.79	3.60	3.24
27C020-15	4.49	4.27	3.84
27C040-12	6.29	5.98	5.38
27C080-12	12.99	12.34	11.11

7400 SERIES I.C.'s

STOCK#	1-24	25-99	100+
7400	.29	.28	.25
7402	.19	.18	.16
7404	.29	.28	.25
7406	.27	.26	.23
7407	.33	.31	.28
7408	.33	.31	.28
7410	.19	.18	.16
7411	.55	.52	.47
7414	.27	.26	.23
7420	.24	.23	.21
7432	.33	.31	.28
7447	.89	.85	.77
7473	.79	.75	.68
7474	.33	.31	.28

FM MICROPHONE KIT

Transmit your voice on any FM radio. Range up to 1000'. Case included.

STOCK#	1-9	10-24	25+
K30	11.99	11.39	10.25

What Do We Have ?

- I.C.'s
- Oscillators
- Crystals
- Diodes
- Tools
- Laser Diodes
- Vises
- Resistors
- Capacitors
- Connectors
- Trim pots
- Kits
- Vices
- LED's
- Transistors
- And more!

GADGETEER'S GOLDINE

This exciting collection of electronic projects features experiments ranging from magnetic levitation and lasers to high-tech surveillance and digital communications.

• By Gordon McComb

STOCK#	1-9	10-24	25+
TB3360	21.99	20.89	18.80

- Order Line — (800) 824-3432 • International — (724) 495-1230 • Fax Orders — (724) 495-7882
- Technical Support — (724) 495-1231 • No Minimum Order — (Orders under \$20 subject to \$5 charge) • UPS 3 day, Blue, Red, & Fed. Ex. Shipping Available (Call for charges) • PA Res. Add 7 % Sales Tax • Open Mon-Fri 9:00 AM - 5:00 PM (EST) • Corporate Accounts / Quantity Discounts Available • We accept M/C, VISA, Discover & American Express with no surcharge • Call For FREE Catalog (\$2.00 Outside U.S.)
- We Carry A Complete Line Of Electronic Components • Email - unielec@aol.com

FREE SHIPPING!!
on pre-paid orders

Unicorn Electronics
1142 State Route 18
Aliquippa, PA 15001

Write in 54 on Reader Service Card.



ALL CABLE NEEDS
SE HABLAN ESPAÑOL
CONVERTERS
ALL BRANDS WITH REMOTE

TOLL FREE ORDER LINE:

1-800-361-4586

ALSO

HOOK-UP HELP LINE:

1-630-889-0281

NO ILLINOIS SALES



COMPETITIVE PRICING

PARENTAL LOCKOUT AVAILABLE

HOURS: Mon. thru Fri.
9-6, Sat. 10-2

30-DAY MONEY BACK GUARANTEE
1 YEAR WARRANTY

KDE ELECTRONICS CORP.
P.O. BOX 1494, ADDISON, IL 60101

Write in 54 on Reader Service Card.

Nuts & Volts Magazine/June 1998 **75**

Multi-Tasking PC WatchDog,
PC ISA & Printer Port Data Acquisition,
Remote Download, Expandable 8051 SBC...

Flex51 starts at \$99! Our stack on cards expand SBC to fit your needs or design your own circuits with the proto board. Projects up in no time!

- 89C5X, 11.059MHz, 4.75"x3.15"
- Download and debug program file then run, all from your PC. Its that simple!
- RS232 & RS485 ports. 5 Ext. Interrupts
- Expansion Cards: A/D, D/A, D/I/O, LCD/Keypad, Counter, prototype board.
- FREE Assembler, Disassembler, Simulator, Basic and C compilers, Manual.

Only \$99

UNIQUE MULTI-TASKING PC WATCHDOG monitors up to 4 programs, resets PC if any one crashes. 30 seconds off-line, is better than a weekend!! Has two 16 bit cnts, 24 D/I/O. Only \$80 PC DATA ACQUISITION CARD, has 24 D/I/O, 8 ch 8 bit A/D, 12 bit counter. PCDA-02 for \$65, PCDA-01 with counter \$75. PRINTER PORT DATA ACQ., 8 ch 8 bit A/D, 8 D/I, 8 D/O for \$87. With case & P/S only \$120. All orders add \$6 s/h.

Innovation West 2275 Huntington Drive, Suite 285, San Marino, CA 91108, voice (626) 309-6085, fax: (626) 309-9972. e-mail: inovwest@aol.com Internet: http://members.aol.com/inovwest/

SURPLUS SALE
1,000,000 WALL TRANSFORMERS



3VDC/100MA CX099 \$0.75
6VDC/100MA CS039 \$1.45
9VDC/100MA CR314 \$1.45
12VDC/200MA CS033 \$0.99
13.5VAC/400MA.. CR574 \$1.29
24VDC/500MA CR174 \$3.40

Min 1000/type -- Call for other types

SURPLUS TRADERS
PO Box 276,
Albany, VT 05440
Tel: (01) 514-739-9328
Fax: (01) 514-345-8303
http://www.73.com/vt
FREE CATALOG!

PROGRAMMERS OVER 50 MODELS

ADVANTECH EETOOLS NEEDHAM DATA I/O ICE TECHNOLOGY HILO SYSTEM GENERAL CHROMA MODULAR CIRCUIT TECHNOLOGY XELTEK

PROMAX EMP-20 MEGAMAX MEGAMAX4 SIMM/SIP TESTER EMUPA

CALL ADVANTECH LABTOOL 629 ICE TECH MICROV 550 EETOOLS ALLMAX + 409 EETOOLS MEGAMAX 509 EETOOLS MEGAMAX4 369 XELTEK SUPERPRO II 409 XELTEK SUPERPRO II P 249 XELTEK SUPERPRO L 165 XELTEK ROMMASTER II 479 MOD-MCT-EMUPA 739 SIAG ORBIT-32

599 EETOOLS SIMMAX 795 CHROMA SIMM/SIP 359 MOD-MCT-EMUPA/R 279 MOD-MCT-EMUP/R 49 EPROM 1G TO 512K 69 EPROM 1G TO 1MEG 99 EPROM 4G TO 1MEG 199 EPROM 16G TO 1MEG 89 EPROM 1G TO 8MEG 129 EPROM 4G TO 8MEG 250 EPROM 8G TO 8MEG

LABTOOL48 MICROMASTER SUPERPRO ALLMAX PLUS ROMMASTER2

General Device Instruments
Sales 916-393-1655 Fax 916-392-4949
Web www.generaldevice.com E-Mail icdevice@best.com

BCD
electro

We'll Buy your excess inventory

IC's, Transistors, Diodes, capacitors, trim pots, etc. etc.

- Purchase outright
- Consignment
- Partnering agreements

Send your excess list for a quick offer!
Contact Bob Harris
Phone (214) 343-2170, FAX 1854
email - bcdelect@onramp.net
web - http://www.bcdselectro.com

Serial Problems???

Use your PC compatible desktop or laptop computer to debug serial communications problems with **Serial**, our test tool for serial communications.

Serial works with the standard data rates and asynchronous serial formats commonly found in modern office and industrial environments. Suitable for development, service work, and end-user problem diagnosis.

- Easy to Use
- Menu and Windows
- Highly Configurable
- Contextual Help
- Autobaud Detect
- Time Stamping
- Custom font editor for EGA/VGA Screens
- Saves Configurations
- Extensive Manual
- Block transmit ability
- CRC/LRC generation

Serial, with manual \$99.95
Cable for full duplex monitoring \$49.95

For Orders and Inquiries Call: 1-800-980-9806
Allison Technology Corporation
8343 Carvel, Houston, TX 77036
FAX and BBS 1-713-777-4746

SEND FOR FREE CATALOG

NEW! SLR 30M, 40M OR 80M RECEIVER KITS WITH ANTENNA. VERY SENSITIVE. HAS HIGH IMMUNITY TO LOCAL AM BROADCAST AND QRN. SEE QST 10/97

..... \$101.50 PP

NEW! THE BEST REGEN RECEIVER KIT EVER! \$91.95 PP

CURTIS KEYSER KIT CODE PRACTICE
MARCONI ANTENNAS OSCILLATOR
J- POLE ANTENNAS \$23.45 PP
SMART BATTERY CONTROLLERS KITS

AC OR SOLAR 110/220 1/2, 1, 3, 5 OR 6 AMPS
BUY THE MODULE OR ENCLOSED VERSION

1-800 JADE PRO (523-3776)
www.jadeprod.com/
email: jadepro@jadeprod.com
JADE PRODUCTS INC. E. HAMPSTEAD NH 03826-0368

PCB's in Minutes From LaserPrint!*

8 1/2" x 11" Sheets

* Or Photocopier Use household iron to apply.

PnP BLUE or PnP WET

For High Precision Professional PCB Layouts

1. LaserPrint
2. Iron-On
3. Peel-Off
4. Etch

Adds an Extra Layer of Resist for Super Fine Lines on Std Clad Bds

For Easy Hobby Quality PCB's

1. LaserPrint
2. Iron-On
3. Soak-Off w/ Water
4. Etch

Transfers Laser Printer or Copier Toner as Resist to Std Clad Bds

205h\$30/405h\$50/1005h\$100 Blue/Wet (No Mix)
Sample Pack 5 Shts Blue + 5 Shts Wet \$20
VISR/MC/PO/CH/MO \$4.50H -- 2nd Day Mail

Techniks Inc. P.O. Box 463 Ringoes NJ 08551
(908) 788-8249

100% Money Back Guarantee-Dealer Inquiries Invited

Convert RS-232 to RS-485 or TTL/CMOS for Only \$49.00

Communicate up to 1,000 feet, at up to 1 MEGA-BPS, full or half duplex, up to 32 units on one serial link, with 31 jumper options for flexible configuration, LED indicators.

COMMUNICATIONS CONVERTER

- FULL SCHEMATIC AND DOCUMENTATION
- FULL FAMILY OF MODULAR DESIGNS
- RS-485/RS-422 REMOTE I/O MODULE KITS
- NETWORK SOFTWARE AND SOURCE CODE
- AUTOMATIC OR RTS UNITS AVAILABLE
- RJ-11/12 CONNECTORS OR TERMINAL STRIP
- TURN YOUR PC INTO A DISTRIBUTED DATA ACQUISITION AND CONTROL SYSTEM

R.E. SMITH
(513) 874-4796
4311 TYLERSVILLE RD. ■ HAMILTON, OHIO 45011
FAX (513) 874-1236

TV 85 PJ & TV 86 CABLE CONVERTERS VOLUME & NON-VOLUME CONTROL

SALES/SERVICE VOICE 1-800-473-0506 FAX 1-800-488-0525

FOSS WAREHOUSE DISTRIBUTORS
285 Schenck St.
N. Tonawanda, NY 14120
www.fossw.com

PCBs PER SQIN \$100.00 SETUP

WE SPECIALIZE IN SINGLE SIDED, 1 OZ, PC75

PCB LAYOUT 59¢

PER COMPONENT PIN \$100.00 MINIMUM

ENGINEERING DIAGRAMS 39¢

PER COMPONENT PIN \$100.00 MINIMUM

V&V MACH. & EQUIP., INC. (HOUSTON, TX OFFICE)
PH (281) 397-8101 FAX (281) 397-6220
MARKETING TECH. S.A. (MEXICO/PLANT)
PH 011 (525) 361-3351 FAX 011 (525) 361-5996

Peltier Junction:

While They Last!

1 3/16" x 1 3/16" cooling area

Quantity Pricing Available

WITH HEATSINK AND LEADS \$10 EACH OR THREE FOR \$25

Shreve Systems 318-424-9777
Ask for Jake

COMREX RGB Composite Display



*refurbished
**90-day warranty

ONLY \$99!!
Great for studio or lab monitors!!
640x480 resolution

Returns subject to a 15% restocking fee. Prices are subject to change without notice.
WE ACCEPT VISA, MASTERCARD, AMEX, DISCOVER
http://www.shrevesystems.com

SPECIAL
ALL MAJOR BRANDS • ALL GUARANTEED

MICRO-PROCESSORS	EPROM	MEMORY MODULES
PIC 16C54	2716	1MEGX32 SIMM
PIC 16C56	2732	2MEGX32 SIMM
PIC 16C57	27C64	4MEGX32 SIMM
PIC 6C58	27C512	
GAL 16V8LP	27C256	
GAL 20V8LP	27C128	
GAL 22V10LP	27C010	
STATIC RAM		
6116	27C020	8748 80C31
6264	27C040	8749 8255
62256	27C080	8751 8254
628128		8752 8259

AND MUCH MORE ...

WE BUY YOUR EXCESS INVENTORY

SINACO ELECTRONICS 818-705-1880
FAX 818-705-1881

ADAPT-11 & ADAPT-12
Low-cost modules for HC11 & HC12 plug into solderless breadboards

- Evaluate your idea instantly!
- Breadboard it, for quick hardware changes
- Program it in-circuit, for quick software changes
- Debug your application-- not the basics!

ADAPT-11 Modules feature three 8-bit I/O ports, SPI, SCI, eight 8-bit analog input channels, hardware timers/counters, & interrupts. All Starter Packages include PC serial download cable, documentation, & disk of utilities & examples. Bundle ImageCraft C for Windows (ICC11) with any Starter Package for an additional US\$120 + \$5 S&H.

HC11 Starter Package Configurations:

AD11-SP	2K EE/256 bytes RAM	US\$ 74.95 + \$5 S&H
AD11-C75-SP	8K EE/512 bytes RAM	US\$ 87.00 + \$5 S&H
AD11-C75DX-SP	8K EE/32K bytes RAM	US\$120.00 + \$5 S&H
AD11-SP64K	ADAPT-11 w/ 32K EE/32K RAM memory expansion card & dual slot adapter (2 I/O ports lost)	US\$123.00 + \$5 S&H

ADAPT-12 features 68HC12A4, (4K EE, 1K RAM, 85 I/O lines, eight high speed 8-bit analog inputs), memory expansion connector, RS232 & RS485, convenient firmware boot loader, plus support for all 8080 pods. All this on a compact 2.25" x 3.25" board. Starter Package (AD12-SP) US\$99 + \$5 S&H. Add US\$125 for ICC12WIN.

AVAILABLE SOON! ADAPT-912 features 68HC912B32 (32K Flash, 768 EE, 1K RAM, 56 I/O lines, 8 chan. analog), RS232 and RS485. All this and more on a compact 2.25" x 3.25" board! Starter Package (AD912-SP) US\$99 + \$5 S&H. Add US\$125 for ICC12WIN.

TECHNOLOGICAL ARTS
voice/fax: (416) 963-8996
www.interlog.com/~techart

HIGH PERFORMANCE ULTRA-MINIATURE PINHOLE LENS CAMERA W/ AUDIO

The PH200A is the smallest pinhole camera in the industry.

- High Sensitivity - needs only .2 lux
- High resolution - more than 400 lines
- Ultra miniature - measures only 30mm x 30 mm x 14 mm
- Camera comes complete with connectors and power supply
- Includes 5.5mm wide angle pinhole lens
- Can be easily mounted behind a 1/8" hole for any custom or covert applications.

ONLY... \$79.95 with ad
Surveillance Catalog \$5.00

SPY OUTLET
2468 Niagara Falls Blvd
Tonawanda NY 14150
(716) 695-8660 Fax (716) 695-7380

Diagnose a Dead PC in less than 60 Seconds



Software Buy Mail offers the P.O.S.T. 1. This hardware card will pinpoint the cause of hardware failure in less than 60 seconds. This hardware works on all machines from an XT to a PII 400MHz. Order today for just \$59.95. Also available QA+FE and QA+ WIN32 just \$199.00 when purchased with P.O.S.T. 1.

Call 1-800-745-6324.
Visa/MC/Amex/Disc/COD.
Fedex delivery available.

Get **A+** Certified Guaranteed

You can be A+ certified in 90 days or your money back! Start your career in PC repair. This is a fully interactive and comprehensive Computer Based Training (CBT) Course to prepare you to pass the A+ exam.

Features:

- All features on one CD-ROM.
- Interactive exercises for practical experience.
- Study at home or work.
- Everything you need to prepare for the A+ exams.
- Affordable price.
- 90 PASS GUARANTEE.

TO ORDER: CALL 1-800-745-6324

Software Buy Mail, 275 Rt. 10 E. #220-289,
Succasunna, NJ

ATTENTION DEALERS

WHOLESALE ONLY!

• ANY CABLE MFGR CONVERTERS & ACC

• BEST PRICING & SERVICE

• SHOP US NOW

PANASONIC • NOVA, ETC.

800-777-7731

CCTV SPECIALS

Panasonic AG-TL500
168Hour Time-Lapse VCR

Built-in RS-232C Interface
On-Screen Display
2hr-108 hour modes
Repeat Pass Indicator
\$750

Detection Dynamics DDC-5000P
Color Pinhole w/Audio



9 vdc • Built-in audio
Small: 42mm x 42mm
400 TVL • 1.0 Lux
\$239

Panasonic AG-RT600
40Hour Real Time VCR

8/24/40hr
Time/Date Generator
Auto Repeat Recording
Alarm Search • Alarm Input
\$650

Detection Dynamics DDLCD4
Active Matrix 4" Color LCD
Monitor



Lightweight for easy mounting
Wide viewing angle
12 vdc • 380 mA
Pro Version \$325
\$239

DETECTION DYNAMICS

Call us for all types of
security & industrial closed
circuit television equipment
www.ddaustin.com

7801 N. Lamar, Suite D-84 • Austin, Texas 78752

(512) 345-8401 • FAX 926-0940

CCTV CATALOG \$5.00 • REFUND W/PURCHASE

EPS

EPROMS AS LOW AS **25¢**

27C256	27C040	27C1024	87C51
27C512	27C400	28F010	8751
2732A	27C4096	28F020	8755
27C32	574000	28F040	68705
27C128	574200	8749H	2564
27C64	27C402	8748H	2516
2716	27C020	8741	8255
2708	27C210	8742	8254
27C512-90	27C010	8744	80C31

STATIC RAM

MEMORY



SPECIAL **2764**

TEL: (818) 774-9444 • FAX: (818) 774-0822

WE BUY EXCESS INVENTORY

FREE SAMPLE COPY! ANTIQUE RADIO CLASSIFIED

Antique Radio's Leading Monthly Magazine

Articles - Classifieds - Ads for Parts & Services. Also: Ham Equip. - Books - Telegraph - 40's, 50's & 60's Radios - Early TV - Auction Reports & more...

1-Year: \$40.95 (\$57.95 by 1st Class)
6-Month Trial - \$20.95. Foreign - Write.

A.R.C., P.O. Box 802-G21
Carlisle, MA 01741
Call: 978-371-0512 — Fax: 978-371-7129
Web: www.antiqueradio.com

EQUIPMENT FOR SALE

ELECTRONIC TEST

Tektronix	EXT 330
Hewlett-Packard	EXT 331
Other Manufacturers	EXT 332
MEASURE & INSPECT	EXT 333
VIDEO PRODUCTS	EXT 370
SCIENTIFIC & LAB	EXT 335
LASERS	EXT 340
POWER SUPPLIES	EXT 334
COBWEB CORNER	EXT 380
MFG	
COMPLETE INDEX	EXT 300

To obtain information via FAX: A) Have your fax number ready. B) Dial 1-800-547-4636. C) Request above Extension Numbers.

DEXIS CORPORATION
(612) 944-7670 FAX (612) 942-9712
9749 HAMILTON ROAD
EDEN PRARIE, MN 55344

CUT MANUFACTURING COST!

CUSTOM METAL BOXES WE ACCEPT SMALL ORDERS TOO

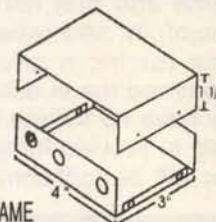
SHEET METAL

20 GAUGE

SILK SCREEN

PRINTED

WITH YOUR CO. NAME



ALSO PCB, SMT, PROTOTYPES, ASSEMBLY.
PLASTIC MOLDS, INJECTION MOLDING.

USA Office: V&V Mach. & Equipment, Inc.
Ph: (281) 397-8101, Fax: (281) 397-6220.
Mexico Plant: Marketing Tech.
Ph: 011 (525) 361-3351, Fax: 011 (525) 361-5996.

Get PIC'n!

Everything you need to get started with the exciting PIC microcontrollers today!

PIC-n-GO Package includes:

ITU PIC-1+ Programmer

- Programs ALL PIC16C55/6/7x/8x/9x, PIC16F8x, and PIC12C devices!
- 5 pin expansion header for In-System Programming and adapters
- Power Supply, Cable, Software, Manuals and Example Programs
- Options: 18 pin ZIF - add \$15
40/28 pin ZIF adapter - \$39

PLUS: a PIC16F84-10/P

Electrically-Erasable

Microcontroller

Only **\$75!**

Kit only \$45

See our Web Page for more PIC products!

Order Toll Free!

(888) 4-ITU-TEC

Visa, MC and AE Accepted

ITU Technologies

3704 Cheviot Ave. Ste. 3, Cincinnati, OH 45211

Phone: (513) 661-7523 Fax: (513) 661-7534

E-mail: sales@itutech.com

ENGINEERING & ASSEMBLY

Producible designs since 1970

Contract Engineering

Embedded Microprocessors
Analog Including RF to 1 GHz
Instrumentation
A/D and D/A
PCB Layout and Packaging Design

Contract Assembly

Kit or Turn-key
Through hole
Surface Mount
Run sizes one through thousands
Test and burn-in available

Bilocon Corp.
800-736-5927
425-353-2276
www.bilocon.com

ST241A
Stereo microscope
\$240.00
New - 1 year warranty

650/367-8320
Fax - 365-5845

Seabird Technical
3580 Haven Avenue
Redwood City, CA 94063-4603
Email: jlittle@netwizards.net

CONTROL • MEASURE • INPUT

MODEL 40-\$109

- RS-232 interface
- 28 lines digital I/O
- Eight analog inputs
- PWM output
- Three stepper ports



MODEL 100-\$279

- 12-bit 100KHz A/D • Four analog outputs
- Three timer counters • 24 digital I/O



PRAIRIE DIGITAL, INC.
920 SEVENTEENTH ST., INDUSTRIAL PARK
PRAIRIE DU SAC, WI 53578
TEL: (608) 643-8599 • FAX: (608) 643-6754

Discount Computer Systems

Intel Pentium II P266MMX MZH Multimedia System

SYSTEMS INCLUDE:

Mid TW. CASE, MB W/P II CHIPS 512 CACHE,
64MB EDO RAM, 5.1 GB HARD DRIVE,
24X CD ROM, 4MB 64 BIT 3D VIDEO CARD,
3.5" 1.44MB FD, 16 BIT 3D SOUND CARD,
33.6 FAX MODEM WITH VOICE,
WIN 95 MOUSE, WIN 95 104 KEYBOARD,
80 WATT SPEAKERS, WIN 95 REL. 2,
17" SVGA MONITOR INCLUDED

\$2999

800-804-6552

PC ADAPTER FOR FIXED FREQUENCY



MING Graphics card will run a Fixed Frequency Monitor just like an SVGA monitor on a standard PC with virtually all colors, DOS text, and graphics up to 1600x1200 resolution.

Specifications — Controller: Tseng Lab 128-bit ET6000, support 4MB MDRAM, MPEG, 3D apps; Tseng Lab 64-bit ET400032P, support 2MG DRAM, PCI or VLB bus. Driver Supported: Windows 3.X/NT/95, AutoCAD, Lotus 123, WordPerfect, 3D, and others. Sync: sync on green (3 BNC conn.), composite sync (4 BNC conn.), separate sync (5 BNC conn.), HV (13W3 conn.). Manufacturers supported: Radius, Hitachi, Sun, HP, Sony, Tektronics, DEC, IBM, Mitsubishi, Ikegami, Appolo, and others.

Call us today at (909) 738-1416
or visit our web site at
<http://www.riverside.quik.com/ming>
Tech Support: (909) 372-0489
Fax: (909) 549-3628

*Looking for the right crowd to promote
your electronic products to?*

RENT OUR LIST!

- ☑ Nuts & Volts Magazine has its mailing list available for rent to qualified electronic firms.
- ☑ The list is comprised of approximately 215,000 electronic enthusiasts in the computer, ham radio, and related fields.
- ☑ Complete or partial rentals are available.

FOR ORDERING OR MORE INFORMATION, PLEASE CONTACT:

Response Media Products, Inc.

2323 Perimeter Park Drive, Suite 200, Atlanta, Georgia 30341-1335

(770) 451-LIST • FAX (770) 451-4929

♦ CALLER IDs ♦

Only **\$3.99** each + S/H
reconditioned

Carbide Drill Bits & Router Bits
.**40¢** each \$10.00 minimum

• FREE CATALOG •

3M Static Bags, Test Equipment,
Components, Phones, Computer
Equipment, and much, much more!

T.T.I.

300 EUGENE ST., S.E.

GRAND RAPIDS, MI 49507

616-475-8531 • 616-475-8534 FAX

RESOURCE BIN

number seventy seven

A look at accessing offshore electronics.

Our usual reminder here that the *Resource Bin* is a two-way column. You can get tech help, consultant referrals, and off-the-wall networking on nearly any electronic, *tinaja* questing, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

Offshore Electronics

Nearly all electronic parts are a lot cheaper from the Far East. Sometimes ridiculously so. Especially when you are buying, say, 100 or more custom double-sided and plated-through circuit boards. Where your costs can be one-third to one-fifth as much as purchasing locally. With worldwide express services, delivery might actually be faster than waiting around forever on an old line US parts distributor or on some uncaring local manufacturer.

How can you tap these sources? Is foreign involvement for you?

Firstoff, let's start off with some obvious warnings. If you do not know what you are doing, you are going to get eaten alive.

You probably do know enough to avoid those tiny "Make big money in import/export ads." Most of these old come-ons look exactly like the scams they almost certainly are. And the big time

stuff like those "Nigerian Bank Account" ripoffs seem only to fool the extremely greedy or the very gullible. This one is making the rounds once again, so it does seem to be working.

Often, foreign involvement will not be for you. I learned a long time ago that non-US response painfully and repeatedly caused me far more grief than it ever returned me in dollars. I personally have no foreign sales. No funding to provide foreign support has or will be forthcoming. Foreign E-

NEXT MONTH:
Don shows us some
star-tup secrets for
your own web site.

Mail is ignored and any letters are returned unopened. My own view is that if you are a success here, you do not need any foreign sales. If you are not, the foreign sales will not help you in the least. Either way, I don't see any point in my seeking these out. Especially after the hassles and grief they have caused me in the past.

If you are genuinely serious about offshore electronics, it will be super important that you learn to speak the language and understand the local customs. Ferinstance, the word "yes" in Japan often does appear to mean something like "I have heard what you said and I understand where

you are coming from." In no manner does it mean anything even remotely like "I will definitely and quickly do what you ask." How something gets done seems more important than *what* is actually getting accomplished. Simple acts such as exchanging of business cards in the proper manner can be of profound and long-lasting importance.

In some other Pacific Rim nations, negotiations are *certain* to *slowly* grind you into oblivion. Taking forever and leaving absolutely nothing for you on the table. As far as bribery, *bakeesh*, or *mordita* go, the question is not if, but just when, how much, and in what manner. And directed only in those places that will do you the most good.

If you do have the opportunity to travel, the place to stop by is Japan's northeastern Akihabara district. This is your ultimate world class "radio row" of all time. Consumer electronic and computer bargains abound. One nice site is 203.141.89.34/japantravel. Even maps are included here.

At any rate, your 500-pound gorilla for finding offshore electronic parts and assemblies is ...

Asian Sources Electronic Components

Asian Sources are a Philippine-based group of a dozen highly successful magazines on Pacific Rim suppliers for products and services. The mag you'd be most likely to want to look at initially is known as *Asian Sources Electronic Components*.

This one is an ongoing fat monthly mostly-ads magazine 600 pages or so. It is usually Japanese, Korean, and Hong Kong offerings for electronic parts. Since the technical content itself is pretty much vapid surveys and a "boom-rah" boosterism, all your real value here lies in the ads and the contacts they provide for you.

Typical recent editorial coverage was on clock radios, RDS receivers (a somewhat languishing method to add digital time, weather, song, artist, call letters, and emergency alerts to FM broadcasts), oversize television sets, language translators, handheld mikes, speakers, and child monitors.

These people also do offer several free finder services. These include a *SourcesFAX* form, a 3-in-1 inquiry form, online support, CDROM, and their personal customer feedback.

One way or another, you tell them what components you are looking for, and they will come up with sources. Not surprisingly, all their magazine advertisers appear

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **\$28.50**

CMOS AND TTL COOKBOOKS

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. **\$28.50 each.**

RESEARCH INFOPACKS

Don's instant cash-and-carry flat rate consulting service. Ask any reasonable technical question for a detailed analysis and complete report. See www.tinaja.com/info01 for specifics. **\$75.00**

INCREDIBLE SECRET MONEY MACHINE II

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **\$18.50**

LANCASTER CLASSICS LIBRARY

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **\$119.50**

LOTS OF OTHER GOODIES

Tech Musings V or VI	\$24.50
Ask the Guru I or II or III	\$24.50
Hardware Hacker II, III or IV	\$24.50
Micro Cookbook I	\$19.50
PostScript Beginner Stuff	\$29.50
PostScript Show and Tell	\$29.50
Intro to PostScript Video	\$29.50
PostScript Reference II	\$34.50
PostScript Tutorial/Cookbook	\$22.50
PostScript by Example	\$32.50
Understanding PS Programming	\$29.50
PostScript: A Visual Approach	\$22.50
PostScript Program Design	\$24.50
Thinking in PostScript	\$22.50
LaserWriter Reference	\$19.50
Type 1 Font Format	\$16.50
Acrobat Reference	\$24.50
Whole works (all PostScript)	\$380.00
Technical Insider Secrets	FREE

BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **\$39.50**

THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. **\$8.50**

BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **\$24.50**

RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **\$24.50**

FREE SAMPLES


Check Don's Guru's Lair at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultants. email: don@tinaja.com

FREE US VOICE HELPLINE VISA/MC

SYNERGETICS

Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Factory Direct



Professional 10 HOUR RECORDER

"BUILT LIKE A BATTLESHIP"

- Heavy duty commercial recorder - NOT improvised from consumer models
- 12, 14, and 16 hour models also available
- BUILT-IN voice activation (add \$30)
- Applications information included
- Dimensions: 11.5 x 7.0 x 2.75"

SPECIAL Nuts&Volts Price..

\$159

FREE 40-PAGE SPECIAL EQUIPMENT CATALOG!

COD'S OK. Sorry, no credit cards. Free catalog USA only; other countries \$5. Price Includes UPS to 48 States on Pre-Paid Orders.

Viking International 150 Executive Park Blvd. #4600 San Francisco, CA 94134
Phone: (415) 488-2066 • Fax: (415) 488-2067 • Web: www.vikingint.com

to dominate the results. The closer you come to their mainstream topics, the better this service becomes.

They do give you a monthly CD-ROM that started off kinda empty, but is certainly becoming more and more useful. These are usually included with each issue of your subscription. Speaking of which, this magazine is not cheap. Prices start at \$80.00 per year for ordinary mail delivery, and range up to \$165.00 for premium air service.

Scoring free copies is tricky. If

RESOURCE BIN

AN OFFSHORE ELECTRONICS RESOURCE SAMPLER

All Shore Industries 1 Edgewater Plaza Staten Island NY 10305 (800) 959-0548	Books in Print 121 Chanlon Rd N Providence NJ 07974 (908) 464-6800	Electronic Components 1020 Church St Evanston IL 60201 (847) 475-1900	New Media 901 Marin Is Blvd #365 San Mateo CA 94404 (415) 573-5170	TTA Communications 12 Falcon Gate Dean Rd Bristol, SG UK BS37 5NH 44 (0) 1454 318 722
Arizona Mexico Comm 1700 W Washington Ste 180 Phoenix AZ 85007 (602) 542-1345	CMP Publishing 600 Community Dr Manhasset NY 11030 (516) 562-5000	Electronic News Box 1051 Southeastern PA 19398 (215) 630-0951	Oxbridge 150 5th Ave #202 New York NY 10011 (212) 741-0231	Ulrich's Dictionary 121 Chanlon Rd New Providence NJ 07974 (908) 771-7714
Asian Sources 1020 Church St Evanston IL 60201 (847) 475-1900	Compliance Engineering 1 Tech Drive Andover MA 01810 (508) 681-6600	Electronics Magazine 1020 Church St Evanston IL 60201 (847) 475-1900	Panel Components PO Box 115 Oskaloosa IA 52577 (800) 662-2290	United Parcel Service 55 Glenlake Pkwy NE Atlanta GA 30328 (800) 782-7892
Audio Amateur Box 576 Peterborough NH 03458 (603) 924-9464	CRC Press 2000 Corporate Blvd NW Boca Raton FL 33431 (800) 272-7737	Heathkit PO Box 1288 Benton Harbor MI 49022 (616) 982-3200	SW Auction Weekley Box 61104 Phoenix 85082 (602) 994-4512	Upside 2015 Pioneer Court San Mateo CA 94403 (650) 377-0959
Bentley Auctioneers 3801 Academy Pkwy N NE Albuquerque NM 87109 (505) 344-1812	EE Times 600 Community Dr Manhasset NY 11030 (516) 562-5000	InternationalBusiness 10711 Burnet Rd Ste 305 Austin TX 78758 (512) 873-7761	Synergetics Box 809 Thatcher AZ 85552 (520) 428-4073	Wireless World/EW The Quadrant, Sutton Surrey SM2 5AS ENG 01-652-3128

you can find an existing copy of an Asian Source pub, there may be a card or two for a free sample of another title in it. By being patient enough and by carefully using these cards, you can scan all their mags.

Web site is www.asiansources.com.

Related Pubs

Actually, *Asian Sources* consists of a bunch of different magazines. You might find some of their other titles of interest as well ...

Computer Products
Electronic Components
Electronics
Fashion Accessories
Gifts & Home Products
Hardwares
Multimedia Products
Telecom Sources
Timepieces
Trade & Travel

The main difference between their electronic titles is that *Electronics* is whole systems such as TV sets, DVD players, boom boxes, and whatever, while *Electronic Components* are all the bits and pieces of circuit boards and individual components and minor assemblies. Their "hardware" title is for drill presses and hinges and the rest of the stuff you'd expect to find at your local hardware store.

Their newest *Trade & Travel* mag bills itself as "The business and travel magazine for international traders," despite its still skimpy size, this one does appear to have bunches of useful content. Of particular interest is their ongoing *Asian Trade Show Calendar*.

Some Directories

Those CRC press folks have been around for a long time. They are the ones who bring you the *Handbook of Chemistry and Physics* and companion standard reference titles. Their latest free *Everything in Electrical Engineering* flyer lists all sorts of titles. Including offshore access directories ...

Singapore and Malaysia Electronics Industry, by Michael Pecht, Donald Beane, and Anand Shukla. 1997, 128 pages \$39.95.

Electronics Industry in Taiwan, by Chung-Shing Lee and Michael Pect. 1997, 176 pages \$39.95.

The Korean Electronics Industry, by Joseph Bernstein, Damion Searls, and Martin Peckerar. 144 pages \$39.95.

I have added access links for these titles to www.tinaja.com/amlink01.html.

International Magazines

Most technically-oriented countries offer at least a few of the electronic magazines. For years and years, the best anyplace ever was the British *Wireless World*. Which long ago did get combined into *Electronics World*. While a shadow of its former self, this one still features its useful mix of understandable and useful hands-on construction projects intelligently combined with more advanced, yet clearly explained topics.

The Dutch have *Elektor Electronics* which does remain a great hobby construction mag. A few years back, there was a US version, but

this mag apparently folded for lack of enough advertising support. Possibly the *Audio Amateur* still does have a few odd copies remaining.

The *CMP Publishing* folks are well known here for their *E.E. Times* and *Computer Reseller* trade journals, plus many others. It turns out they also have a lot of international titles ...

Cabling & Networking (Italy)
Design & Electronik (Germany)
E.E. Times Taiwan (Taiwan)
Electronic Engineering (England)
Electronic Times (England)
Elektronik i Norden (Scandinavia)
Markt & Technik (Germany)
Micro Electronics (Taiwan)
Mundo Electronico (Spain)

Nikkei Electronics (Japan)
PCB International (EEC)
PCB Magazine (Italy)
Productronica (Spain)
Selezione Di Elettronica (Italy)
Technologies Magazine (Israel)
What's New in Electronics Europe
What's New in Electronics UK

Here's a listing of some of the other international technical trade journals from a stunning variety of worldwide publishers ...

Asia Computer Weekly
Audio-Video International
Australian Electronics Engineering
Asian Electronics Engineer
Business Travel Asia Pacific
Canadian Electronics
Currency Alert: Asia
Currency Alert: Latin America
EDN Asia
EDN China
EDN Europe
EIC Electronique
Electronic Business Asia
Electronic Commerce Report
Electronics & Comm in Japan
Electronics Foreign Trade
EPIT Electrosource

ATTENTION DEALERS: WHOLESALE ONLY!

EXCLUSIVE:



NEW!

Wavemaster 99 Channel

• Sleep Timer • Std./HRC Switch • Parental Control

10+	20+	50+
\$57	52	45



Formerly JES, Inc.

BEST PRICES!

FAST SERVICE

SAME DAY SHIPPING



	5+	10+	20+
Panasonic 145	\$72	65	60
Refurb. Panasonic 145	57	55	52
Panasonic 100	52	49	--
Panasonic 175	--- CALL! ---		
Starcomm DQN	49	45	39
(99 ch; Refurb.)			

TOLL FREE: 800-322-9690



FAX: 516-246-5634

RESOURCE BIN

Global Electronics
Int'l Jnl of Electronic Commerce
Japan Consumer Electronics Scan
Pacific Telecommunications
Test & Measurement Europe
TWICE

Way over on the non-technical side, *International Business* can be a useful trade journal. Subtitled *Strategies for the Global Marketplace*. It is from *New Media Publications* and their website is at www.internationalbusiness.com. And *Upside* is a Silicon Valley Yuppie tech management mag that occasionally has useful international info in it.

Technical Support

A number of firms offer offshore assembly that gets combined with US engineering and technical support. These folks tend to advertise in such trade magazines as *Electronics News* or *Electronic Buyer's News*.

One random sample example is *All Shore Industries* at www.allshore.com. Their specialties do appear to be PC boards and assemblies combined with global sourcing and procurement.

One resource for strong technical support on most anything involving international cord sets and connectors is *Panel Components Corporation*. These folks have a fat catalog chock-full of international power specs.

As usual, really fine information on international standards can be found in *Compliance Engineering*.

Most of the main package delivery services offer international services. Your obvious starting point here will be www.ups.com.

Some Additional Web Sites

A nice collection of international web sites hosted by *Arizona Central* appears at

www.azcentral.com/community/azmex/amcin/tweblinks.shtml.

Some of their links include ...

Asia Development Bank
Bureau of Export Administration
Census Bureau
Environmental Protection Agency
Export Legal Assistance Network
International Monetary Fund
International Standards Org
International Trade Administrations
Japan External Trade Organization
National Trade Data Bank
Phoenix Export Assistance Center
SCORE Program
Trade Compass
Trade Point USA's I-Trade
Trade Port
NABank
NAFTA Small Business Information
United Nations Trade Development
US Agency for Int'l Development
Virtual Africa

Arizona Central gets involved with that *Arizona-Mexico Commission* where you can find more information on the *Maquiladora* and its related twin-cities programs. These let you combine US engineering and "offshore" assembly.

They might also provide you with useful consultant referrals.

A potentially interesting web site that targets international telecomm is the *Open World Markets* site from *TTA Communications*. They bill themselves as the "world's first online technical information service for international telecommunications manufacturers." Their web site is www.ttauk.com. This one is a fee-based service.

Yet another useful resource is at www.asia-inc.com. Their site includes Far East business news, along with a searchable data-

base plus an Asian Internet directory. For more personal business news, job hunting, and for extensive online links, you might also want to check www.asiaville.com.sg.

The content at www.chinabig.com is a comprehensive online Yellow Pages and bilingual resource.

Finally, look into www.asiatrader.com that claims to have everything in Asia from travel to insurance, import to export, conventions to banking. Even online betting.

This Month's Contests

For our contests this month, just tell me about a useful foreign electronics access resource I don't already know about. Or tell me some horror story which involves you and an offshore whatever. Please skip the "Are you bringing anything back?" "I hope not." jokes. Or else add to our technical education dialog.

There should be a largish pile of my new *Incredible Secret Money Machine* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

To be fair to everyone, all entries must be written and submitted via snail mail. Send all your *written* entries to me here at *Synergetics*, rather than to *Nuts & Volts* editorial.

Further Help

A reminder that one of the best ways to find info on any magazine anywhere in the world is by way of the *Oxbridge Media Finder* stashed at www.mediafinder.com. If that one does not work, and if the usual web tools don't help, there's always good old *Ulrich's Periodicals Dictionary* on the reference shelf at your local library. I sure do hope that Ulrich's eventually gets freely on line. So far, they haven't the foggiest clue that they've already clearly been done in by an aggressive "free info" online stance at Oxbridge. To me, Ulrich's clearly seems about to become roadkill.

One good source for book info is *Amazon Books*, <http://www.amazon.com>. Once again, *Books in Print*, as your original horse's whatever source seems to be in dire jeopardy because of their lack of free online support.

I guess there's an obvious hidden message buried somewhere here. One of the big reasons that you have to even think about going offshore for electronics parts and products is the utterly abysmal lack of electronics education in the US.

Very few high schools offer anything at all in the way of electronics training. Trade schools largely have dried up as their federal subsidies vanished. Some that remain are of questionable quality. Quite a few community colleges are either discontinuing their electronics programs outright or sharply cutting back on them. Caused mostly by the aerospace downsizing a decade ago.

Lots of old-line distributors have now made it outrageously

When Visiting Disney World And Sea World...
Come To The World Of Electronic Surplus!

SKYCRAFT

PARTS & SURPLUS, INC.
ORLANDO, FLORIDA



Located At The Intersection Of I-4
And Fairbanks Avenue.

A Self-Service Retail Outlet Featuring Commercial
And Government Electronic Surplus Including:

- | | |
|--------------------|-----------------------|
| ★ WIRE | ★ COAX |
| ★ SWITCHES | ★ RELAYS |
| ★ RESISTORS | ★ HARDWARE |
| ★ TRANSISTORS | ★ CAPACITORS |
| ★ TRANSFORMERS | ★ PANEL METERS |
| ★ TEST EQUIPMENT | ★ CIRCUIT BOARDS |
| ★ NI-CAD BATTERIES | ★ INTEGRATED CIRCUITS |

★★★★★★★★

**We Buy Surplus
Electronic Parts —
FAX your list.**

FAX 407/647-4831

PH 407/628-5634

P.O. BOX 536186

ORLANDO, FLA. 32853-6186

HOURS:

Monday - Friday 8:30-6:00
Saturday 8:30-5:00



**WHOLESALE
CABLE BOXES**

CONVERTERS • FILTERS



**THE BEST
DEALER
PRICING!**

**Call Us To
Satisfy All Of Your Cable
Equipment Needs!**

**WE CARRY ALL
THE MAJOR
BRAND NAMES!**

**30 DAY MONEY BACK
GUARANTEE!
1 YEAR WARRANTY**



Call Now and Take Advantage!!!

MODERN ELECTRONICS

1-800-906-6664

2609 S. 156TH CIRCLE • OMAHA, NE 68130

VISIT OUR WEB SITE: <http://www.modernelectronics.com>

E-MAIL: modern@modernelectronics.com

difficult to cheaply pick up a few parts. But new sources such as www.questlink.com do seem to be picking up on the slack. Heathkit is pretty much gone as a personal learning resource. Although they still do host quality educational electronics on a low profile basis.

Electronic kits in general are largely in disarray. For the simple reason that nobody knows how to solder any more. Other more informal technical education sources (such as ham radio clubs) have pretty much lost much of their relevance.

To me, all of this is shooting your seed corn in the foot. It also seems monumentally and incredibly short-sighted. One useful side effect: there are now mind-boggling great auction buys as the schools fold their classes. See the www.auctionadvisory.com link from Southwest Auction Weekly and others on www.tinaja.com/beewb01.html for the latest auction info. Or the great Bentley's Auctions link you'll find on www.tinaja.com/dntkwb01.html. These fine people at Bentley can be your ultimate source for quality electronic test gear. Offered by the semi load.

Or check out RESBN73.PDF and my Resource Bin reprints for

Microcomputer pioneer and guru Don Lancaster is the author of 35 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also offers a free catalog full of his unique products and resource secrets. The best calling times are 8-5 on weekdays, Mountain Standard Time

Don is the webmaster of his Guru's Lair found at <http://www.tinaja.com/tinaja>. Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to don@tinaja.com.

the insider electronic auction secrets. Or do visit www.barg01.html for all of the goodies themselves.

Custom assistance in pinning down any electronic component or service is found at www.tinaja.com/info01.html.

Let's hear from you. There's some exciting new opportunities here. NV

AIRCRAFT SEXTANT



w/ PERISCOPE, used in older military aircraft to determine nightflight position. Cupped eye-piece views through right angle periscope with bubble level. Controls vary bubble size, adjust lens diffuser plus filters red, green & polarized. Also mechanical timer, 3-digit 100-turn counter dial & fiberglass transit case. Great experimenter item! Requires 28 V AC -DC for lights; 8"Wx13"Hx5.3"D, 23 lbs. #MS28011-1F, used, \$75-\$65.

TEKTRONIX 465M SCOPE



AN/USM-425 militarized DC-100 MHz dual-trace oscilloscope with 8x10 CM display. Deflection 5 mv to 5 V/div in 10 calibrated steps, 1-2-5 sequence + vernier. Vertical modes: TRIG View, 20 MHz BW, CH 1, ALT, Add, Chop, CH 2 or X-Y. Sweep 0.05 usec to 0.5 S/div in 22 steps + vernier; delay 0.05 us-50 ms/div. Also X10 magnifier, adjustable handle, front cover & manual copy. Requires 100-132 V 48-440 Hz; 7x1.7x21.5, 32 lbs sh. USED-CHECKED, \$475.

Lifting Body Balloon



Distress-orange inflatable "manta ray" shaped balloon measures about 8 feet nose-to-tail, wing-tip-to-wing-tip; 3 feet at thickest. Designed to raise a wire antenna for air-sea rescue transmitter. Slight breeze lifts it much easier than round balloon even when air-filled; 3 lbs sh. #SEB-42-ALV, unused, \$25.00

TETHER WIRE, 306 foot spool of vinyl-covered braided #22-size antenna wire intended for use with balloon or kite; 3 lbs sh. #SEB-400X3, unused, \$12.95

Prices F.O.B. Lima, Ohio. VISA, MASTERCARD accepted.

Allow for shipping charges. Write for latest Catalog.

Address Dept. NV + Phone 419/227-6573 + FAX 419/227-1313

E-mail: fairradio@wcoil.com Home: <http://alpha.wcoil.com/~fairradio>

FAIR RADIO SALES CO.

1016 E. Eureka + Box 1105 + Lima, Ohio 45802

Write In 46 on Reader Service Card.

LOWEST DEALER PRICE BUY DIRECT FROM THE WHOLESALER



CENTURION CF-3000

- 100 Channel • Parental Lock
- Std/HRC/Switch • Timer

★ **5+ 10+ 50+**
\$65 \$59 \$55

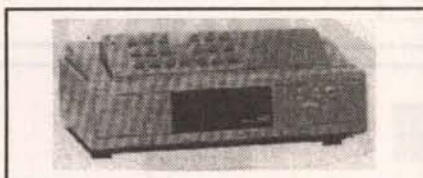
REMOTE CONTROLS

	10+	50+	100+
Zenith	\$4.95	\$4.50	\$4.25
Tocom 5503-VIP	\$4.95	\$4.50	\$4.25
Pioneer BR-81,82	\$5.50	\$5.25	\$4.95
S/A 8600	\$5.95	\$5.65	\$5.50
Panasonic 170,175	\$5.95	\$5.65	\$5.50
Jerrold 400,450-550	\$4.95	\$4.50	\$3.95
CFT	\$5.50	\$5.25	\$4.95
S/A 075,175,475	\$4.95	\$4.50	\$4.25

PANASONIC TZPC-145 (RAN)

- 99 Channel • Parental Lock
- Std/HRC/Switch

★ **5+ 10+ 50+**
\$55 \$49 \$45



REFURBISHED CONVERTERS

60-Channel + Remote
Only \$19.00

70-Channel + Remote
Only \$25.00 minimum 10 lot



CALL FOR PRICING
ON ITEMS NOT LISTED

INTEK ELECTRONIC SYSTEMS 405-634-1535

CALL FOR
FREE
CATALOG

30-day money back guarantee, 1-year warranty

Write In 47 on Reader Service Card.

RF Data Modules



Transmitters

- Only 30 x 10 x 5mm
- 0.25mW into 50Ω
- 3V(F), 5V(F) or 6-12V(A)
- Up to 20k bps data transfer
- 418MHz or 433.9MHz FM
- Simple to integrate - simply add antenna, data and power
- Range up to 200m
- Analog or digital data i/p
- SAW controlled - stability

TXM-4xx-A..... \$24.50
TXM-4xx-F..... \$25.80



Receivers

- Only 21 x 47 x 5mm
- 13mA; 130μA on power save (100:1)
- Carrier detect o/p
- Simple to integrate
- Up to 20k bps (F version)
- 418 or 433.9MHz FM Superhet
- SAW stability
- Analog or digital o/p
- Wide supply range 4.5-9V (A/F ver.)
- Fast enable time <3ms

SILRX-4xx-A..... \$39.38
SILRX-4xx-F..... \$41.92



Transceivers

- Only 23 x 33 x 11mm
- Up to 40k bps
- 19200 baud with ASCII
- Up to 170m range
- 5v operation
- 0.25mW into 50Ω
- 418 or 433MHz FM
- Fast 1ms enable
- Direct interface to 5V CMOS
- Auto TX/RX changeover

BIM-4xx-F..... \$87.36

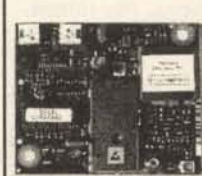
RS232 Transceivers



- 4,800 to 38,400 bps half duplex
- 3-wire RS232 interface
- μController with user EEPROM
- RS232 interface protected to ±15kV
- Auto TX/RX changeover
- 418 MHz and 433MHz versions
- Range 120-200m
- 0.25mW & 10mW options
- Reset switch and status LED's
- 7.5-15V dc via DB9 connector 20mA

BIM-4xx-RS232 \$139.30

Synthesized Transceivers



- 64 channels
- 464.075-464.850MHz
- Integral loop antenna
- External antenna option
- 5V operation
- Up to 2km range
- TTL logic level I/O
- 10kbps data rate
- <100μA in sleep mode
- 10mW RF o/p power

TXR-464-DTR100 \$313.50



ABACOM
TECHNOLOGIES

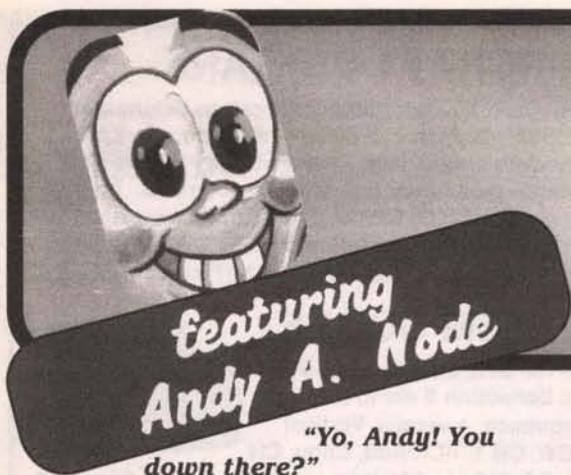
Free Catalog

32 Blair Athol Crescent, Etobicoke, ON, M9A 1X5, Canada

TEL: (416) 236 3858

FaxBack: (416) 231 9681

Fax: (416) 236 8866



THE WEEKEND WORKBENCH

featuring
Andy A. Node

Andy Builds An IR Switch

Don't clap — zap that light on/off with your VCR remote

"Yeah, come on down. Wait, let me get the lights."

"How did you turn on the stairway light without getting up, and what's that beeping noise?"

"It's my latest project, an infrared 'clapper.'"

"But it sounds like beeping, not clapping."

"Not that kind of clapping. Instead of clapping my hands to activate a remote-controlled switch, I'm using infrared emissions from my VCR's remote control to turn the light off and on. Watch. Press the power button once, and the light comes on. Press it again, and the light goes off. The beeping sound you hear is a piezo buzzer that sounds off when the infrared light is detected — the same invisible light that triggers the switch."

"Can you use the channel buttons to control different lights?"

"I could, but I kept this project simple. No matter which VCR button I push, the results are the same. Once on, once off. By simply detecting the presence of an infrared beam, and not its embedded code, I can use my TV or stereo remote — or almost any handheld remote — to activate the switch, too. Here, try it. Decoding the keypad takes a lot more circuitry, which could turn this one-night project into a semester project. Maybe someday in my spare time ..."

Construction

Hi everybody! It's good to be back. When I first started working on this project, I went to Radio Shack and bought up every IR (that's the handle the experts use when referring to infrared) item they had on the shelf. You know, phototransistors, LEDs, and matched optical devices. My intent was to start from scratch and build the ideal IR system.

Well, as Robert Burns (the Scottish poet) once said, 'The best laid schemes o' mice and men /Gang aft a-gley.' Loosely translated, it means that unforeseen factors often prevent us from attaining our goal. This was my case. Not only was the part count increasing at an alarming rate as the design progressed, but it was becoming increasingly unstable.

Back to the drawing board and my parts catalogs. Here's where I

discovered the elegant solution, the GP1U52X IR detector module. This little 40-KHz IR detector — available from nearly all mail-order outlets and Radio Shack — reduces the circuitry needed to detect IR signals to a single three-lead device. (The module actually comes in three different frequency ranges from 32 KHz to 40 KHz, so shop around for one that fits your IR remote.) I quickly plugged this module into my design and breathed a sigh of relief. A couple tweaks here and there to reduce interference from room lights, and voila! I was in business (Figure 1).

The printed circuit board for my project is hardly bigger than a Priority Mail (\$3.00) postage stamp and mounted on it are the tin-can IR module, two ICs, and a half-dozen smaller components. You can find a copy of my design on our Web site (<http://www.nutsvolts.com>) under the name IR_RELAY.ZIP. The file contains a complete schematic, foil pattern, board layout, and a parts list.

You'll notice that I broke the design into three parts (that's because the plastic box held three circuit boards). This project consists of three well-defined stages (Figure 2). First,

Kids and beginners — be sure and have someone help you with the final installation of this project if you intend to hook it up to an AC light switch. This should *only* be done by a qualified person!!

there's the sensor, followed by a relay and, of course, a power supply. You can build the IR switch using a separate board for each stage, as I did, or you can place all three side-by-side on one circuit board.

Detector Module

The heart and soul of the switch is the GP1U52X IR receiver/demodulator (see "How It Works"). While using these detector modules seems straightforward, there are a few bumps along the way. The single most important construction detail involves the metal case, which must be grounded. If you don't tie the case to ground, you'll get extraneous signals that'll trigger the relay when you least expect it. If your controlled device is something like a light bulb, it's just an annoyance. But if you are controlling a motor or have incorporated the circuit into your latest robotics, these surprises are no fun.

I also noticed that the IR detector is quite sensitive and it can be easily overwhelmed by stray sunlight or room lights. Halogen lamps are especially offensive. While I've been able to filter out most of this unwanted interference using a simple RC filter, there are situations where ambient light reduces the sensor's range to mere inches.

The obvious solution is to

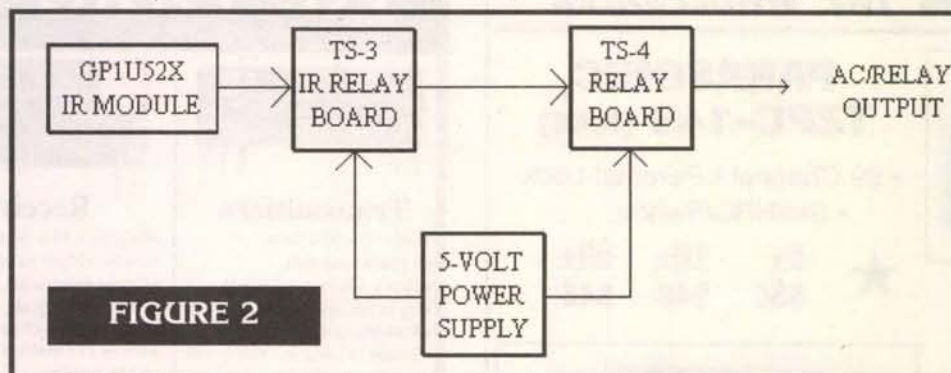


FIGURE 2

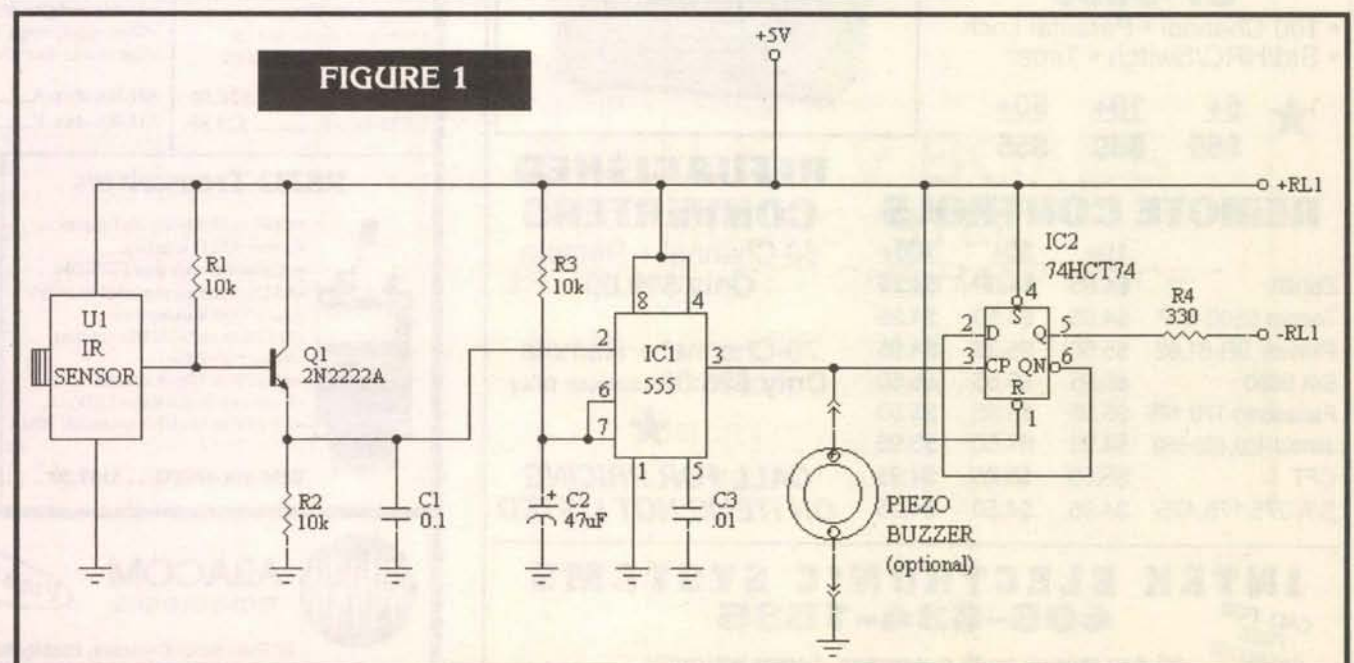


FIGURE 1

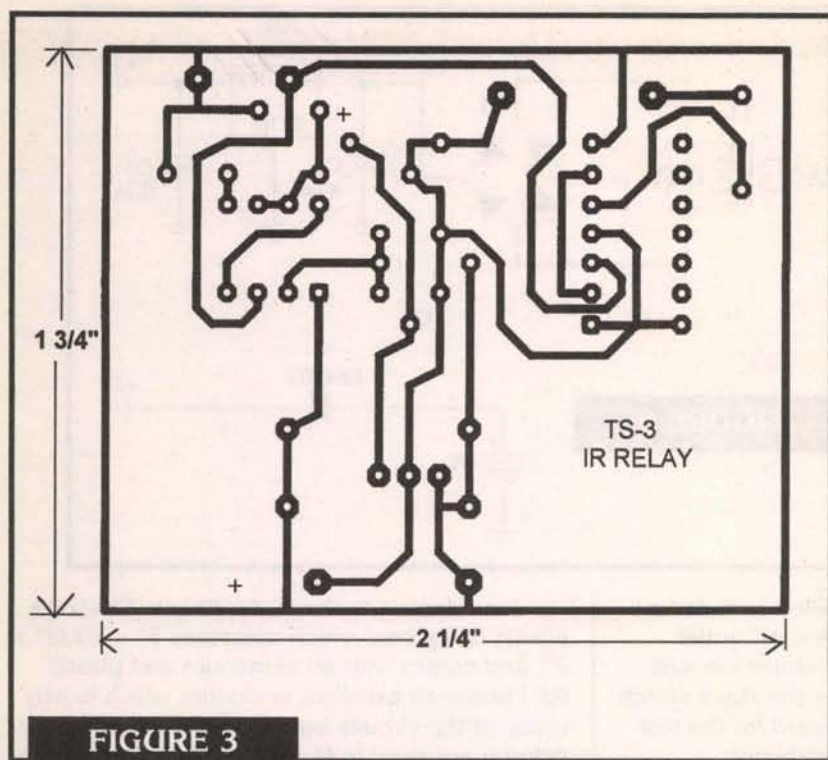


FIGURE 3

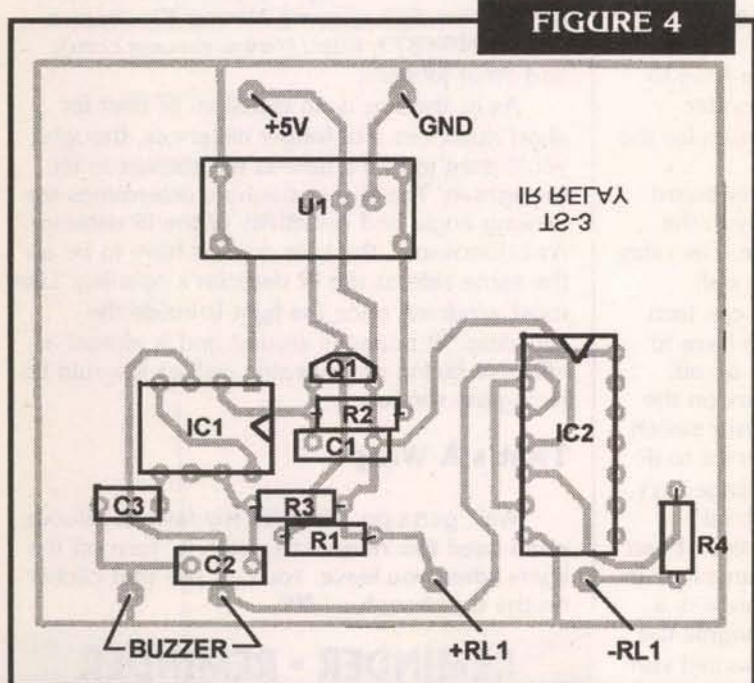


FIGURE 4

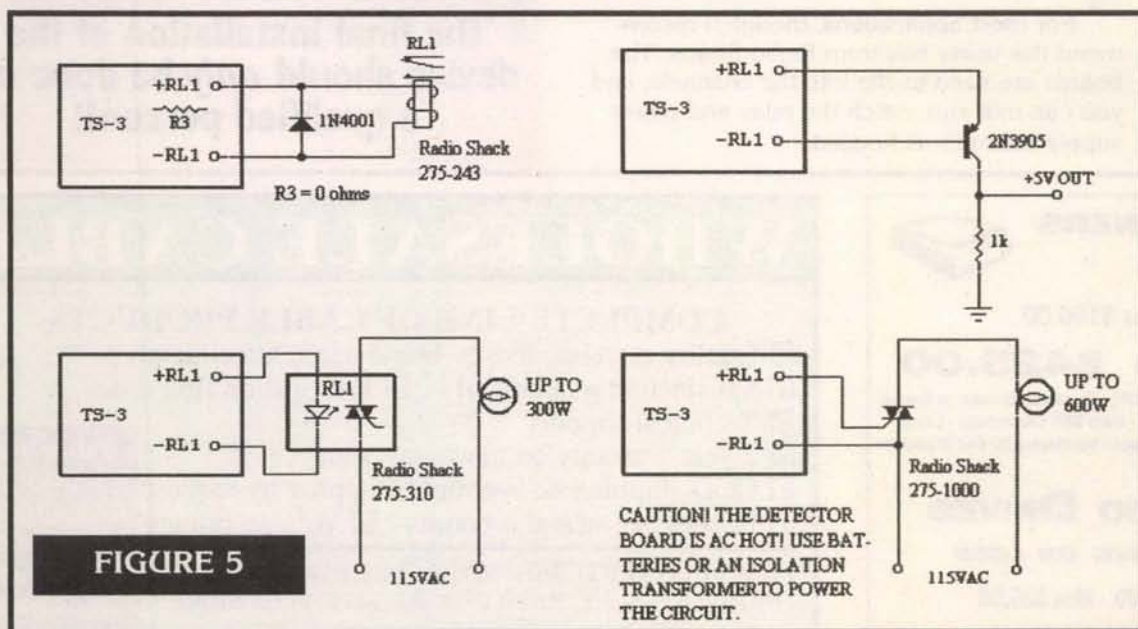


FIGURE 5

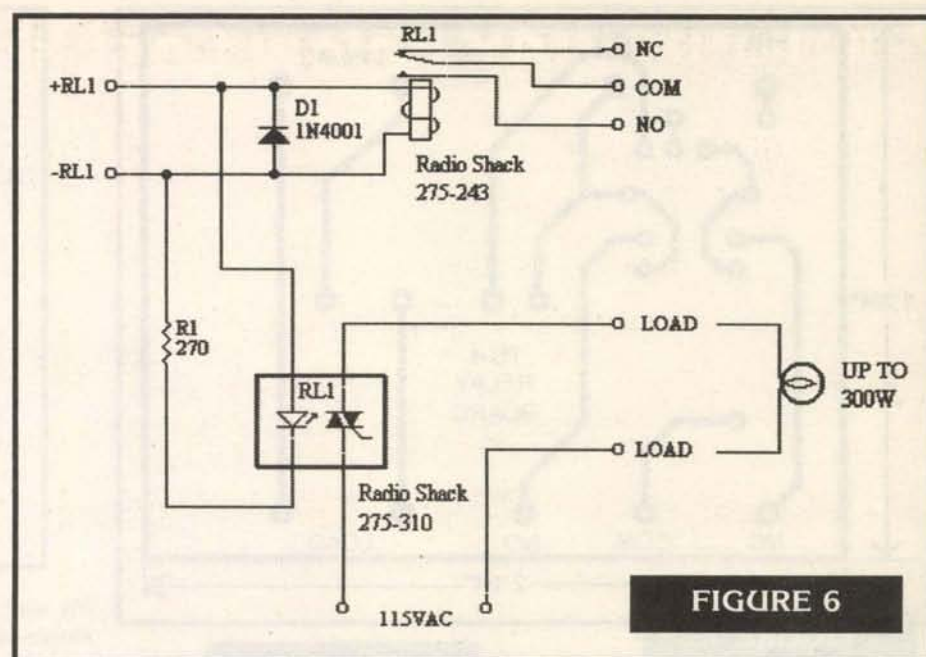


FIGURE 6

light a lot.

Another thing I noticed in my experiments is that the black plastic case you see here — the one I bought from Radio Shack — is also transparent to IR. I didn't realize it until I started positioning the circuit boards inside the box and aligned them so that the IR detector would face outward. When I put the cover on the box for fitting and zapped it with my VCR remote, I was shocked to hear the beeper chirping. I hadn't even cut out the window hole yet!

As it turns out, many products that we think are light tight are plate-glass windows to IR. Anyway, I toyed with this for a while and discovered the cabinet to be a perfect IR filter for short distances. The unshielded range of the detector is about 30 feet, give or take a couple feet depending on the power of the remote, whereas the range of the sealed

Relay Output

You'll notice in my design, the relay is off the detector board. I did this to have a wider variety of switching options, as shown in Figure 5. The mechanical relay can handle 2A, while the solid-state relay and triac can handle 3A (300W) and 6A (600W), respectively.

R3 is a current-limiting resistor for use with the solid-state devices. When driving a coil relay, though, you need to short out R3 with a jumper wire and add a damping diode across the winding. Of course, you can use the open-collector TTL output to drive any load you wish up to about 10 mA.

I use relays in my designs so often that I've made a separate relay card. It's like a staple ... you know, flour and salt. I simply pull a relay board off the shelf and slide it into a slot in the cabinet. The card contains two relay devices. One is a five-volt mechanical single-pole, double-throw (SPDT) relay and the other is a single-pole (SPST) AC solid-state relay. Both are from Radio Shack.

You can duplicate my relay card (Figure 6) using the foil pattern and parts layout shown in Figure 7 and Figure 8. While my relay boards host both devices, you don't have to. The mechanical relay sells for \$2.99 and the solid-state relay sells for \$6.99. The cheaper relay works with both AC and DC at 2A, and the more-expensive solid-state relay can handle AC only. In my original design, there's a three-pin berg connector (the same kind used to set the CPU speed on motherboards) to select between the two relays. For my projects, I simply insert a jumper wire in place of J1.

Power Supply

If you opt for the triac as a switch, pay attention to this caution: **This configuration connects to the AC power line, so you have to isolate the five-volt power supply to prevent sparks.** A small transformer-isolated power supply (Figure 9) is the logical choice. This circuit is nothing more than a full-wave rectifier housed in a small DIP chip, a 78L05 linear voltage regulator, and a couple capacitors. One of these days, I'll get around to putting this on a printed circuit board, too, but for now I have it on a perf board.

The alternative is a battery pack made up of four cells or a wall transformer. The current drain is just 3 mA, which means an alkaline "AA" cell will last about a 1,000 hours. That's equal to about 40 days and 40 nights. Four "C"

eliminate the unwanted light using an IR filter. You can make a cheap IR filter using exposed film leaders from old color negatives. While these black strips are opaque to ordinary light, they are nearly transparent to IR light. A couple layers of this film cut to size and placed over the grill of the IR detector tames the ambient

black box is five feet.

While I took the time to fabricate a printed circuit board (Figure 3 and Figure 4) for my IR detector, the circuit layout isn't critical and you can use any construction method you like. Just make sure to ground the GP1U52X's metal case.

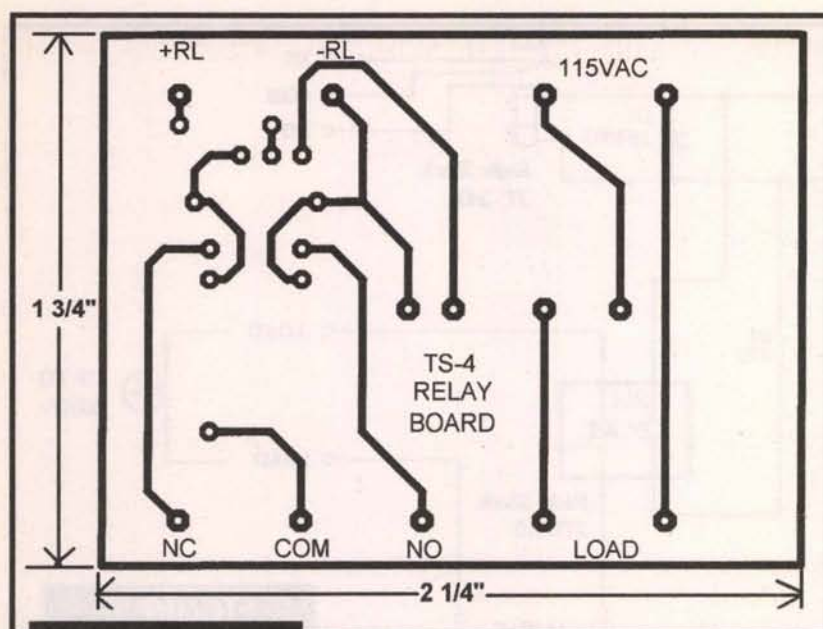


FIGURE 7

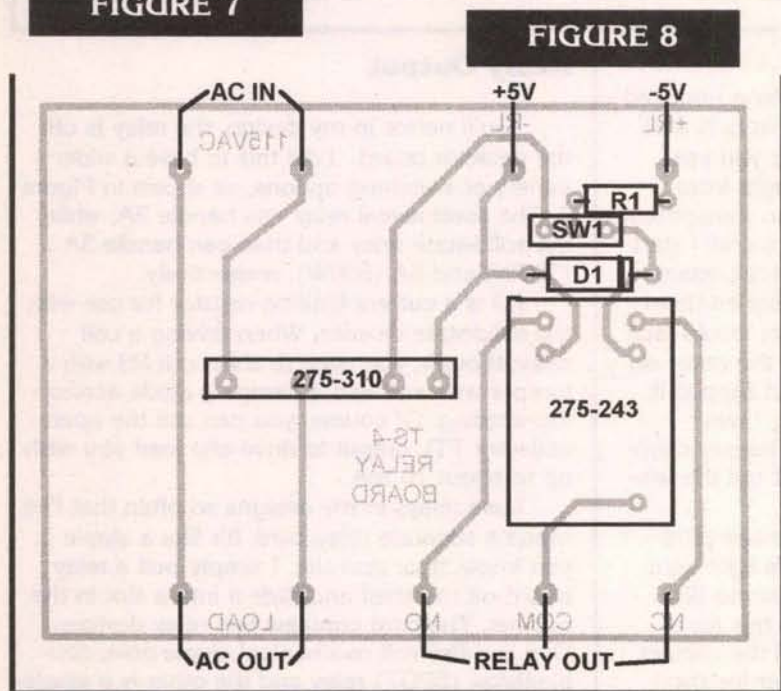


FIGURE 8

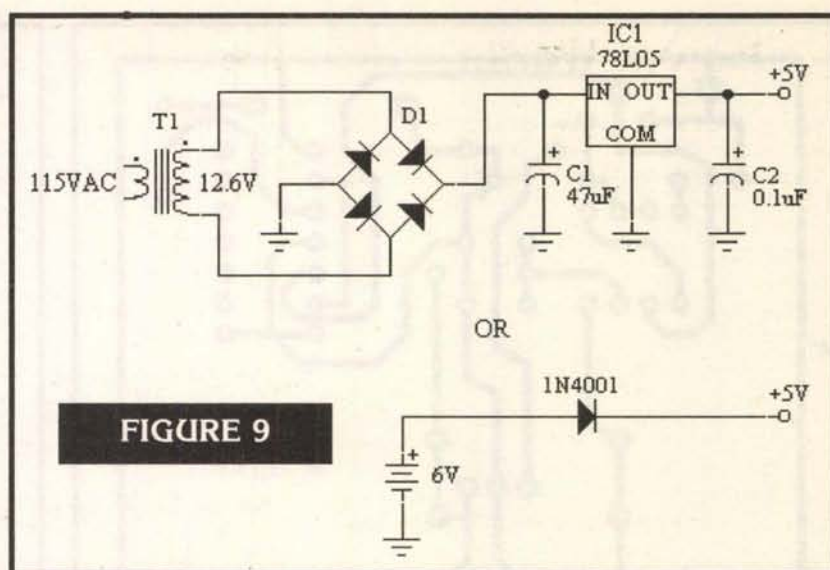


FIGURE 9

My wall switch included a single-socket AC outlet, which is why I chose the wall transformer for the stairs switch and the perf-board for the test unit on the workbench.

Give Me A Home ...

The last thing we have to do is button it up. Wonder where I hid the IR switch for the stairs light?

I put the IR sensor board and a solid-state relay in the switch box over there. The relay is paralleled with the wall switch so that either can turn on the light, but both have to be off for the light to be off.

Like the black box on the bench, the plastic cover switch plate is fairly transparent to IR light, and while the range isn't as great as it would be if I drilled a hole in the plate, I can

easily turn on and off the light from anyplace in the workshop. Actually, the limited range is a plus because the VCR remote won't toggle the workshop lights when I'm upstairs channel surfing.

For most applications, though, I recommend this utility box from Radio Shack. The boards are sized to slip into the channels, and you can mix and match the relay and power supply modules as needed.

I'm referring to the Radio Shack 270-1803 plastic utility box, which measures 5" x 2-1/2" x 2", and comes with an aluminum and plastic lid. I find it an excellent enclosure which is why many of the circuits boards you'll find in this column are sized to fit in this case. You can buy a similar box from Digi-Key (1-800-344-4539; <http://www.digikey.com>), Mouser Electronics (1-800-346-6873; <http://www.mouser.com>), and other jobbers.

As is, the box is an excellent IR filter for short distances. For longer distances, though, you'll want to drill a hole in the cabinet to let the light in. The size of the hole determines the viewing angle and sensitivity of the IR detector. As I discovered, the hole doesn't have to be on the same side as the IR detector's opening. Like most windows, once the light is inside the "building," it bounces around and is almost as effective facing an opposing wall as it would be facing the window.

That's A Wrap

Well, gotta go. Time for my favorite sitcom, and I need this remote to watch it. Turn off the lights when you leave. You can use that clicker on the workbench ... NV

REMINDER • REMINDER

The final installation of the device should *only* be done by a qualified person!!

cells will tow the line for 100 days and "Ds" will get you from January to August. Should you decide to use a battery pack, you must insert a diode in series with the batteries (Figure 9 again). The diode has a 0.7-volt voltage drop across it, which reduces the 6.8 volts of a fresh battery pack to an acceptable 6.1 volts. (The Vcc limit of the IR detector module is 6.3 volts.) It would be wise to filter the output of a 5V, 300 mA wall transformer with a 470 µF capacitor.

NEW HP IICX COLOR SCANNERS

JUST \$185.00

SCANNER DOCUMENT FEEDERS OR TRANSPARENCY ADAPTERS \$100.00

USED HP DUPLEX LASER PRINTERS \$425.00

HEWLETT PACKARD IIID - MIO PORT to NetWork - 300 DPI - CAN PRINT DOUBLE OR SINGLE SIDED - DUAL TRAYS - 3 MEG OF MEMORY (EXPANDABLE) - USES 95A CARTRIDGES - LEASE RETURNS, EACH WELL MAINTAINED UNDER SERVICE CONTRACT - NO HASSLE 30 DAY WARRANTY



ULTRA SCSI HARD DRIVES

BRAND NEW 5 CENTS A MEG OR LESS

TOWER CASES w/200W P/S... FULL \$35.00 - MID \$30.00 - MINI \$25.00

The List Grows Daily!! So Check the Web Site for More Low Prices

ELECTRO MAVIN

800-421-2442 OR FAX 310-632-3557

E-MAIL john@mavin.com OUR WEB ADDRESS IS

<http://www.mavin.com/mavsales.htm>

** SHIPPING UPS FROM THE LOS ANGELES AREA

WHOLESALE CABLE

COMPLETE LINE OF CABLE PRODUCTS

- ☑ Quality merchandise by brand name manufacturers
- ☑ Satisfaction guaranteed ☑ Free gift on first order
- ☑ Technical support
- ☑ 2 year warranty on new converters
- ☑ COD shipping & overnight shipping by request
- ☑ Experience where it counts ☑ Volume pricing

PLAIN CONVERTERS: ZENITH, OAK, PANASONIC, PIONEER, EAGLE, HAMLIN, STARGATE, PLUS MORE.

REMOTE CONTROLS: ALL MAJOR BRANDS, INCLUDING 2-4 FUNCTION UNIVERSAL REMOTES

WHOLESALE CABLE M-F 11am-6pm EST (800) 909-4333
(718) 262-0900 • FAX (718) 657-4015 • (718) 297-9221

No NY sales. Federal and local laws provide criminal and civil penalties for unauthorized use. Check with your cable providers for permission to use equipment. Must be paying for all services you receive. Order by model number only. Some equipment refurbished as new.

Tell us the best price you were offered, where you got it from, and let us try to beat it.

How It Works

At the heart of our IR switch is a GP1U52X infrared receiver/demodulator module (Figure 10). This module is a hybrid IC designed for use as an IR detector for TVs, VCRs, and audio components. The GP1U52X uses a PIN photodiode that has a peak sensitivity in the near-infrared range (940 nm). Near-infrared means it's very near the visible spectrum and can be seen by some birds and bees, but is invisible to us.

A PIN diode differs from rectifier diodes in that there is an insulating layer between the P-doped and N-doped junctions. The thickness of this insulating layer is such that it's extremely sensitive to near-infrared light, and the stronger the light source, the less effective this layer is at insulating. The more intense the light source, the greater the current flow.

The output of the PIN diode is processed by a special integrating amplifier that separates the ambient light from the IR signal. Critical to the separation of ambient light and signal is a bandpass filter that rejects all signals outside the bandpass of 40 KHz. The cut-off points are 38 KHz and 42 KHz, which spans the range of the majority of handheld remote controls. Following the filter is a rectifier circuit — made up of a diode, integrator, and comparator — that turns the 40-KHz burst into a logic high output.

Most remotes have a code that identifies the button pressed. Well, we're not impressed. That is, we don't care which button is pressed, just the fact that a 40-KHz signal is present. This causes a lot more trouble than you'd first think. Unless this code is ignored, the switch has the equivalent of Tourette's Syndrome, with spastic changes in the controller caused by the logical equal of Morse code dots and dashes — and cursing. So I fed the output of the already heavily-filtered IR signal through another filter. This filter consists of two parts: R2 and C1, and IC1, a 555 monostable timer (Figure 1).

Normally the 555 is triggered by a negative-going pulse. What is little known is that the input of this chip is a voltage-triggered comparator — not an edge-triggered logic input. What I did was insert an RC filter driven by Q1 on the trigger (pin 2). When a 40-KHz signal is detected, the open-collector output of U1 turns on and Q1 turns off, which causes C1 to discharge through R2. When the voltage reaches $1/3 V_{cc}$, the 555 triggers. This prevents false signals from the remote's coding.

The output of the 555 goes to a CMOS flip-flop. Tickle it once, and it's on; tickle it again, and it's off. Beyond this we have the relay, which can be any of many choices (Figure 5). The mechanical relay option switches both AC and DC currents up to two amps. The solid-state relay can handle three amps, but its triac switcher is an AC-only device. The triac version is tied to the AC line, so pay heed to the caution in the text.

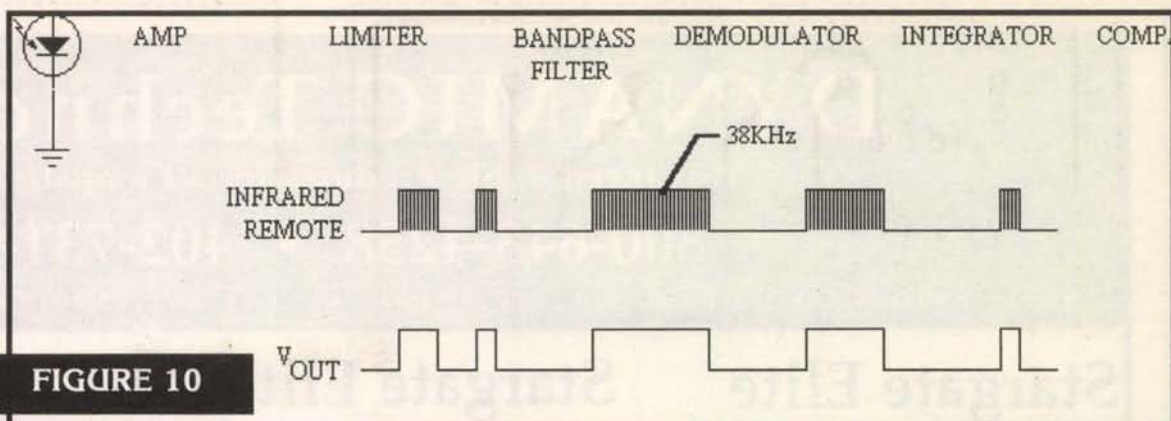


FIGURE 10

Parts List: IR Detector

Reference	Description	Digi-Key	Radio Shack
Semiconductors			
IC1	LM555	LM555CN-ND	276-1723
IC2	74HCT74	MM74HCT74N-ND	276-2816
Q1	2N2222A	2N4401-ND	276-2058
Resistors			
R1,R2,R3	10K	10KQBK-ND	271-1335
R4	330	330QBK-ND	271-1315
Capacitors			
C1	0.1uF	EF1104-ND	272-1069
C2	47uF	P5230-ND	272-1027
C3	0.01uF	EF1103-ND	272-1065
Misc.			
U1	GP1U52X	LT1060-ND	276-137
Piezo buzzer	See text	P9966-ND	273-060
Cabinet	See text	HM104-ND	270-1803

Note: An etched and drilled printed circuit board is available from Circuit Design, P.O. Box 5415, Central Point, OR 97502 (541-664-7904; <http://www.cdsnet.net/Business/circuits/>). The price is \$6.00 plus \$1.00 S/H (\$3.00 for Priority Mail). Request part number TS-3.

Parts List: Relay Board

Reference	Description	Digi-Key	Radio Shack
Semiconductors			
D1	1N4001	1N4001GICT-ND	276-1101
Resistors			
R1	270 ohms	270QBK-ND	271-1314
Misc.			
RL1	SS Relay	GH7002-ND	275-310
RL1	5V, SPDT relay	Z100-ND	275-243

Note: An etched and drilled printed circuit board is available from Circuit Design, P.O. Box 5415, Central Point, OR 97502 (541-664-7904; <http://www.cdsnet.net/Business/circuits/>). The price is \$6.00 plus \$1.00 S/H (\$3.00 for Priority Mail). Request part number TS-4.

Parts List: Power Supply

Reference	Description	Digi-Key	Radio Shack
Semiconductors			
D1	FW rectifier	DF01M-ND	276-1161
IC1	78L05	NLM78L05FA-ND	276-1770
Capacitors			
C1	47uF	P5230-ND	272-1027
C2	0.1uF	EF1104-ND	272-1069
Misc.			
T1	12V, 300 mA	T309-ND (see text)	273-1385B

Low Cost PICmicro Programming Tools



EPIC Plus Pocket PIC Programmer

Programs PIC12C50x, 67x, 16C55x, 6xx, 7xx, 8xx. Optional ZIF adapters for DIP, SOIC, PLCC. Runs off two 9-volt batts or optional AC adapter. Includes programming software and assembler. \$59.95



PICProto Prototyping Boards

Get it wired quicker! High-quality blank prototyping boards for PICmicros. Holds 5V reg, caps, osc, DB9-25, large proto area. \$8.95 - \$17.95



Your first PicBasic Pro program:

LCDOUT "Hello World!"
END

New! PicBasic Pro Compiler

Now it's even easier to program the fast and powerful Microchip PICmicros. PicBasic Pro converts your English-like BASIC programs into files that can be put directly into a PICmicro. BS1/2 library. True compiler for faster and longer programs. Direct and library access to any pin. Built-in LCD support. Interrupts in BASIC. For mid-range PIC12C67x, 16C55x, 6xx, 7xx, 8xx. \$249.95 (Standard PicBasic Compiler \$99.95)

microEngineering Labs, Inc.



Box 7532 Colorado Springs CO 80933

<http://www.melabs.com>

(719) 520-5323 (719) 520-1867 fax

email: info@melabs.com



E.H. Yost & Co.-YOUR SOURCE FOR



★ BATTERIES! ★

- ★ AMATEUR / COMMERCIAL / AVIATION RADIO ★
- ★ LAPTOP COMPUTERS ★ VIDEO CAMCORDERS ★
- ★ CELLULAR & CORDLESS TELEPHONES ★
- ★ SEALED LEAD ACID ★ PHOTOGRAPHY ★
- ★ MEDICAL EQUIPMENT ★ TESTING EQUIPMENT ★

CALL OR WRITE TODAY FOR OUR FREE CATALOG!

Phone (608) 831-3443 / Fax (608) 831-1082

E.H. Yost & Company 2211-D Parview Rd., Middleton, WI 53562

DYNAMIC Technologies

Advanced Cable Products for a Competitive World

800-643-4258 • 402-731-9555

Suite 541064 • Boystown, NE 68154 • Fax 402-734-4243 • www.dynamictec.com

Stargate Elite

- Slim Line Remote
- 550MHz / 83 Channel
- Parental Control
- Unlimited Favorite Channel
- HRC / Standard Switchable
- Auto Fine Tune
- Manual Tune Override
- 1 Year Warranty

As Low As \$38.50

Stargate Elite Plus

- Volume Control
- Audio/Video Out
- Slim Line Remote
- 550 MHz / 83 Channel
- Parental Control
- Unlimited Favorite Channel
- HRC / Standard Switchable
- Auto Fine Tune
- Manual Tune Override
- 1 Year Warranty

AS
LOW
AS

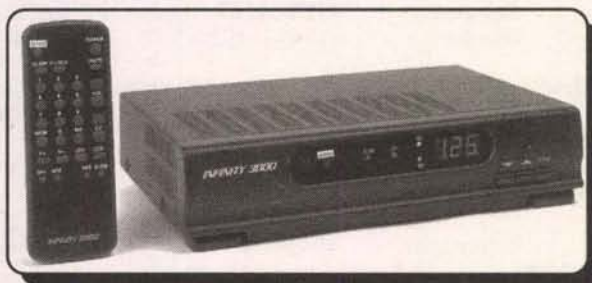
\$59.95



Infinity 3000

- SHARP 125 Channel Tuner
- Dynamic Memory Recall
- Parental Control
- Last Channel Recall
- Unlimited Favorite Channels
- Slim Line Remote
- Automatic Fine Tune
- Micro Card Slot
- Volume Control
- Audio /Video Outputs
- Sleep Timer
- Automatic Low Signal Enhancer

SHARP's™ New Premium Dynamic Tuner
No Other Cable Box Gives a Sharper Picture



AS LOW AS \$77.00

Stargate Infinity 3000A

- Advanced Addressable Base Band Decoder
- Upgradeable Micro Decoder Card
- 125 Channel / 800 MHz
- Volume Control
- Audio/Video Outputs
- Sleep Timer
- Automatic Low Signal Enhancer
- Dynamic Memory Recall
- Parental Control
- Last Channel Recall
- Unlimited Favorite Channels
- Slim Line Remote
- Automatic Fine Tune

NEW

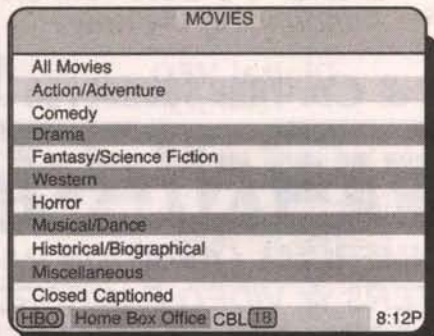
AS
LOW
AS

\$169.00

The Ultimate Navigator Series

Starting at \$219.00

- Advanced Baseband Replacement
- Interactive On Screen Display
- 250 Channel Capable
- Watch One Premium While Recording Another
- Parental Control with timed lock/unlock schedules
- Watch and Record
- Easy Read Clock
- Preloaded Channel Labels
- Unique Favorite Channel Theme System
- V-Chip Ready
- Audio/Video Input and Output
- Addressable/Programmable
- Electronic Program Guide Available*



*StarSight Electronic Program Guide Exclusive to the Navigator Series

- One Touch Recording
- Eliminates Complicated VCR Programming
- Current, Future or Series Recording
- Categorizes All Programming
- Displays Time, Date, Rating, Starring Actors, and More
- Seven Day Programming Schedule
- Free Ninety Day Subscription

All products are FCC approved and comply with the 1996 Telecommunications Act Section 304, Subsection 629 entitled Navigation Equipment. In accordance with the 1996 Telecommunications Act, all Dynamic products with decoding functions are addressable and must be activated by an authorized cable system.

C Pointers and Linked Lists

This article helps you understand pointers and provides linked list code that you can use in your own applications.

by Jeff Stefan

Pointers, dynamic memory allocation, and linked lists can be confusing even to some advanced C programmers, and most beginning programmers avoid them at all costs (I know I did). There's some mental tricks you can use in order to understand these advanced concepts and use them to your advantage. In order to overcome these sometimes bewildering aspects of C, you have to learn to think like a compiler.

Basic Pointers

You've probably heard it a thousand times: a pointer holds a memory address. Think of a memory address as a mailbox. The mailbox is at a fixed address, and never changes. What goes in the mailbox changes (new mail goes in and out). That's the data. Here's when it's convenient to think like a compiler.

When you declare a variable in your program, such as an integer variable `MyVar`, the compiler needs to put it somewhere. It has a lot of addresses to choose from, so it picks one and tags it with the name

`MyVar`. When the program runs, `MyVar` can hold many different values, but its address never

changes, as shown in Figure 1.

In our example, address `0xFFFF2` is the address that the compiler assigns to `MyVar`. Storage for variables like `MyVar` is reserved at compile time, which implies that the programmer knows how much storage the program needs when it runs. This is fine for single variables like `MyVar`, but what about situations where file data needs to be read, and you don't know in advance how many data elements are contained in the file? This is where pointers, dynamic memory allocation, and linked lists come into play.

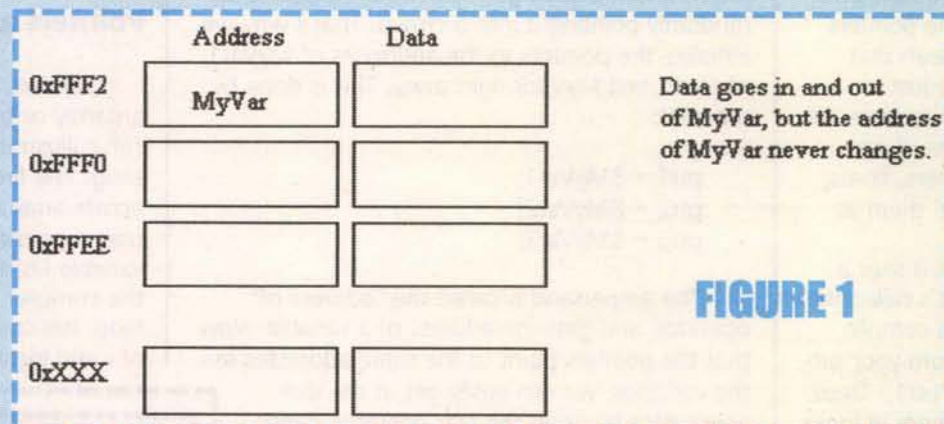


FIGURE 1

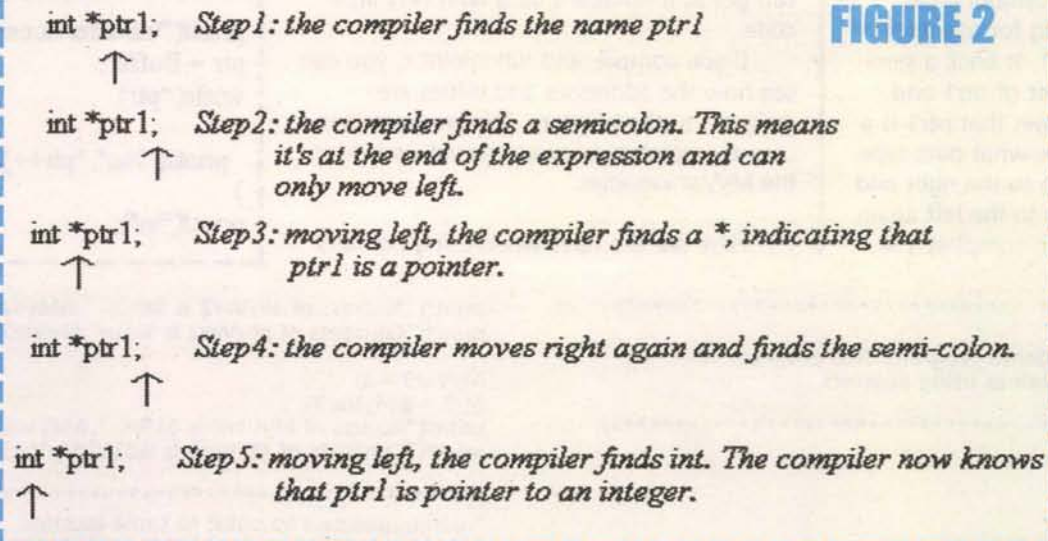


FIGURE 2

So what are some of the things pointers are good for? For one, pointers allow you direct access to memory and require fewer machine instructions than non-pointer code. Look at the listing of the pointer code example, `cpoint.c`. The program declares three variables:

```
int MyVar1 = 0;
int MyVar2 = 0;
int MyVar3 = 0;
int *ptr1;
int *ptr2;
int *ptr3;
```

`MyVar1` through

UNDETECTABLE PHONE TAP

- SOPHISTICATED ULTRA HIGH IMPEDANCE CIRCUITRY AS USED BY CIA AND KGB
- NOT DETECTABLE BY EVEN THE MOST ADVANCED TAP SWEEPING EQUIPMENT
- MONITOR CONVERSATIONS, FAXES AND DATA WITHOUT FEAR OF DETECTION
- PLUG INTO ANY TELEPHONE LINE WITH NO CLICK, HUM, NOISE OR VOLTAGE CHANGE
- UNIVERSAL DESIGN ALLOWS MONITORING WITH HEADPHONES, TELEPHONE OR TAPE RECORDER
- VOICE ACTIVATED TAPE RECORDER CONTROL
- DISGUISED AS "TELEPHONE LINE TESTER"
- COMPACT SIZE - BATTERY POWERED



\$109.95 VISA MC COD

Ar² Communications Products

Box 1242 Burlington CT 06013



(203) 485-0310

W2FMI High Power BALUNs and UNUNs

- Ratios from 1:1 to 16:1
- Covers to 50 MHz
- Up to 5Kw
- 1 Year Warranty
- Kits Available

From \$49.95

www.bytemark.com/w2fmi



Technical Specifications Online!
www.bytemark.com/amidon

DDS From Your PC! Announcing the new PC-VFO jr!

Digital VFO
Only \$139

PC Plug-in card
DC to 54 MHz
.029 Hz Steps
+7 dBm Output

Works with any ISA motherboard

www.bytemark.com/waveguide

800 679-3184

ByteMark Corporation
7714 Trent St
Orlando, FL 32807
407 673-2083 FAX
407 679-3184 Voice


```

/*****
 * non-pointer method of accessing Buffer elements using
 * index variable.
 *****/
printf("\nBuffer access using index variable\n");
for(i=0;i<10;i++)
{
    printf("%c",Buffer[i]);
}

```

FIGURE 3

MyVar3 are declared in the usual way, but the pointer declarations *ptr1 through *ptr3 are different. The variable names have a star in front of them. This tells the compiler to reserve storage a pointer, and that's all. We declared the pointers to be of type int, but this does not mean that ptr1 through ptr3 are integers! We've just informed the compiler that we intend to have the pointers hold the addresses of integers. If we wanted the pointers to access characters, floats, or structures, we would have declared them as such.

What does the compiler do when it sees a declaration like *ptr1? It applies what's called the right-left rule. Here's how it works. At compile time, the compiler first reads a line from your program text, encountering the line int *ptr1;. Once it has the line of program text in memory, it looks for the variable name. It finds ptr1, and saves that in a data structure called a symbol table. Then it scans to the right, looking for any additional information regarding ptr1. It finds a semicolon, so now it moves to the left of ptr1 and finds a *. The compiler now knows that ptr1 is a pointer, but it does not yet know what data type ptr1 will point to. It moves again to the right and finds the semicolon, then moves to the left again to find int. Now the compiler can complete the

entry in the symbol table for ptr1. The compiler now knows that ptr1 is a pointer to integers. Figure 2 illustrates the right-left rule for int *ptr1. You can read any complex declaration by using the right-left rule.

The pointers are now declared, but they aren't pointing to anything useful.

In fact, the pointers are pointing to random locations in memory. An uninitialized pointer is probably the most dangerous thing in a C program. It's like having a loaded gun with a hair trigger and randomly pointing it into a crowd. That's why we initialize the pointers to the addresses of MyVar1, MyVar2, and MyVar3 right away. This is done by the lines:

```

ptr1 = &MyVar1;
ptr2 = &MyVar2;
ptr3 = &MyVar3;

```

The ampersand is called the "address of" operator, and gets the address of a variable. Now that the pointers point to the same addresses as the variables, we can easily get at the variable's data by using the star operator, denoted as *. Pointers are so useful because you can get at a variable's data with very little code.

If you compile and run cpoint.c, you can see how the addresses and values are assigned to the pointers. The program then uses the pointers to swap the values held in the MyVar variables.

Here are the rules when using pointers

as shown in cpoint.c:

1. To declare a pointer, use the star operator, *, as in int *ptr1.
2. To assign an address to a pointer, use the & operator on the right hand side and don't use any operator on the pointer side, as in ptr1 = &MyVar.
3. To get the data the pointer points to, use the * operator again, as in printf("the value of ptr is %d", *ptr).

Single step through the code a few times to get a feel for how these simple pointers work.

Pointers and Arrays

Pointers are especially useful when scanning an array or buffer. The program listing for bufscan.c illustrates two methods of scanning an array. The first method uses an index variable to access array elements, and the second method uses a pointer. As shown in Figure 3, the index variable i is used in a for loop. Think about what the compiler needs to do. To execute the for loop, the compiler must first access the address of i and increment its value in the for loop. To

```

/*****
 * Set pointer to start of buffer and print values
 *****/
printf("\nBuffer access using pointer\n");
ptr = Buffer;
while(*ptr)
{
    printf("%c",*ptr++);
}
printf("\n");

```

FIGURE 4

```

/*****
 * Filename: cpoint.c
 * Description: Simple C pointer demo program. This program
 *             shows how to swap values using pointers.
 * (c) 1997 Jeff Stefan
 *****/
#include <stdio.h>
#include <conio.h>

void main(void)
{
    int MyVar1 = 0;
    int MyVar2 = 0;
    int MyVar3 = 0;
    int *ptr1;
    int *ptr2;
    int *ptr3;

    clrscr();
    /*****
     * Right now, the pointers are pointing to random
     * locations in memory (uninitialized pointers). This is
     * the most dangerous state a pointer can be in. It's
     * like holding a loaded gun with the safety off!
     *****/
    printf("\nUninitialized pointer values are:\n \
    ptr1 = 0x%X\n ptr2 = 0x%X\n ptr3 = 0x%X\n",ptr1,ptr2,ptr3);

    /*****
     * assign vars and pointers and print results
     *****/
    MyVar1 = 1;
    ptr1 = &MyVar1;
    printf("\nAddress of MyVar1 is 0x%X ",&MyVar1);
    printf("Contents of MyVar1 is %d\n",MyVar1);

    MyVar2 = 2;
    ptr2 = &MyVar2;

```

```

printf("Address of MyVar2 is 0x%X ",&MyVar2);
printf("Contents of MyVar2 is %d\n",MyVar2);

```

```

MyVar3 = 3;
ptr3 = &MyVar3;
printf("Address of MyVar3 is 0x%X ",&MyVar3);
printf("Contents of MyVar3 is %d\n",MyVar3);

```

```

/*****
 * assign pointers to point to same location
 *****/
ptr1 = ptr2 = ptr3 = &MyVar1;
printf("\nAddress of ptr1 is 0x%X ",ptr1);
printf("Contents of ptr1 is %d\n",*ptr1);

```

```

printf("Address of ptr2 is 0x%X ",ptr2);
printf("Contents of ptr2 is %d\n",*ptr2);

```

```

printf("Address of ptr3 is 0x%X ",ptr3);
printf("Contents of ptr3 is %d\n",*ptr3);

```

```

/*****
 * Swap contents of MyVar1 in MyVar2. First, assign
 * pointers to point to the addresses of the variables.
 *****/
ptr1 = &MyVar1;
ptr2 = &MyVar2;
ptr3 = &MyVar3;

```

```

/*****
 * Next, move the contents of the pointers to swap values
 *****/
*ptr2 = *ptr1;
*ptr1 = *ptr3;
*ptr3 = *ptr2;

printf("\nMyVar1 and MyVar3 after swap is %d and %d\n",*ptr1,*ptr2);
}

```


find the index value of Buffer, the compiler must again find the address and value of i. That's a lot of work just to extract a character value out of a buffer or array!

Now, let's look at the pointer version, shown in Figure 4. First we assign ptr to point to the starting address of Buffer. In the while loop, the pointer is de-referenced. All this means is that we're getting the value that the pointer holds, or the contents of the pointer by using the star operator.

The printf statement in the while loop does all the work, specifically the expression *ptr++. What does the compiler do when it sees this expression? First, it gets the contents of what ptr is pointing to. We already set the ptr to point to the first location of Buffer, so there is no reason to calculate Buffer's address, so the value we access is right where we're pointing, at Buffer[0]. We access the data stored at Buffer[0] by using the star operator. After the contents of ptr is printed, ptr is incremented to the next address by using the ++ operator, allowing us to access the next value in Buffer, which is Buffer[1]. With this simple construct, we can quickly traverse a large buffer with a lot more speed and efficiency than by using the static indexing method. Compile and single step through bufscan.c to see it in action.

Dynamic Memory

After you get reasonably comfortable with pointers, the next big hurdle is understanding and manipulating dynamic memory allocation. A lot of C programmers shy away from dynamic memory allocation and rely on static arrays or arrays of structures for data storage. There are two disadvantages to storing data this way. The first disadvantage is that all storage must be reserved at compile time. Whether you need all of the storage when the program executes is beside the point. A programmer must consider the worst case storage scenario and must always allocate the maximum amount of memory needed.

The second disadvantage is that all of the storage for statically declared variables reside on the stack, and the heap goes to waste. The stack is where the compiler puts the variables declared at compile time along with function return addresses and other data. The heap is where dynamically allocated variables go, which are brought into existence when the program runs by

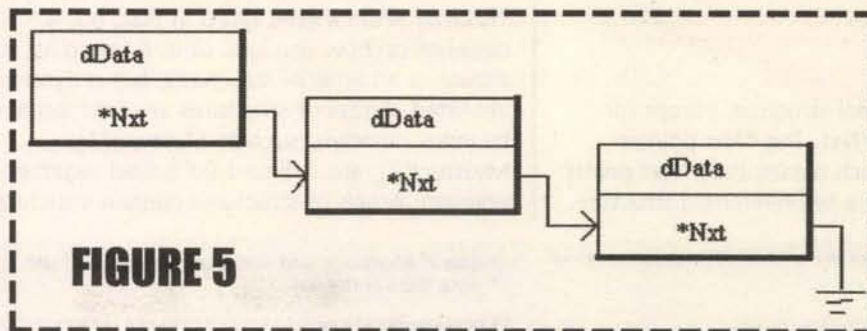


FIGURE 5

dynamic memory allocation.

If all of the variables are put on the stack, the stack may occasionally overflow while the program executes. In an embedded system, this is a disaster. You, the programmer, are left with a debugging nightmare while the heap resource goes untouched. It's like having a party and shoving everyone into a broom closet and not letting them into the rest of the house. Remember, memory is there for you to use, not to ignore.

So how do you use the heap? Use the C standard library utility functions malloc(), calloc(), realloc(), and free(). The most commonly used function for memory allocation is malloc(). When the compiler encounters a call to malloc(), it winds up making a request to the operating system for a finite amount of storage for an object. The object can range from a single byte to an array of structures. If memory is available, a pointer is returned to the starting location of the newly available memory. If the requested memory is unavailable, a NULL is returned.

When the program is done with the object, a call to free() returns the memory to the operating system. Think of the advantages. Memory is used only when you need it in your program. It also puts you, not the compiler, in control over how memory is used. Here's how to allocate storage for a 20 byte buffer and load in the character 'a' into the first buffer byte:

```
char *Buffer;
Buffer = malloc((char ) 20);
if (Buffer == NULL)
{
    printf ("Can't malloc buffer\n");
    exit(0);
}
*Buffer = 'a';
```

The variable Buffer now points to the starting

address of 20 bytes we asked for.

When the program is finished using the buffer, it returns it to the operating system memory using free(), as follows:

```
if(Buffer)
    free(Buffer);
```

If you're confused about when to use the star operator, just remember this: to declare a pointer and to get at the data it holds, use the star, to get at the address of the pointer or to assign a pointer to a variable or data structure, don't use the star. Look at the call to malloc() and think about what we really want to do. We want to ask the operating system to reserve 20 bytes of storage and to let us know where we can get at the first of the 20 bytes. What we're after is the address of the start of the buffer, so we don't use the star. When we want to access or manipulate the data by loading an 'a' into the first position, we used the star.

Linked Lists

Linked lists are pervasive in advanced programming, and if you want to bring your C skills to a professional level, you need to learn how to work with lists. Lists are a flexible and ubiquitous data structure, and you'll no doubt encounter them sometime in your programming career. The example program, linklist.c, shows how to create and use a simple linked list. You can use this program as a base for your own linked list projects. Here's how it works:

The header file, linklist.h, contains the linked list structure template, which is:

```
struct lst {
    double dData;
```

```
/* *****
* Filename: bufscan.c
* Description: using a pointer to scan for a character
*             in a buffer.
*
* Listing #2
*
* (c) 1997 Jeff Stefan
* *****/
#include <stdio.h>
#include <conio.h>

void main(void)
{
    char Buffer[10];
    char *ptr;
    int i;

    clrscr();

    /* *****
    * Copy string into Buffer
    * *****/
```

```
strcpy(Buffer,"Hi There!!");
```

```
/* *****
* non-pointer method of accessing Buffer elements using
* index variable.
* *****/
printf("\nBuffer access using index variable\n");
for(i=0;i<10;i++)
{
    printf("%c",Buffer[i]);
}

/* *****
* Set pointer to start of buffer and print values
* *****/
printf("\nBuffer access using pointer\n");
ptr = Buffer;
while(*ptr)
{
    printf("%c",*ptr++);
}
printf("\n");
}
```

160
591
214
239
530
260
1128
1657
624
103
D1.dat


```
struct lSt *Nxt;
};
```

It looks like a normal structure, except for one item, the pointer *Nxt. The *Nxt pointer points to struct lSt, which means that *Nxt points to itself. This makes lSt a self-referential structure.

This may seem a little weird at first, but it depends on how you look at it. A linked list is similar to an array of structures, but is dynamically allocated. Arrays of structures are held together by index numbers, such as MyStruct[1], MyStruct[2], etc. A linked list is held together by pointers. Arrays of structures contain structures of

the same type. In order for a list pointer to point to the same type of structure, the *Nxt pointer needs to be of the same type as the structure, which is itself.

Figure 5 shows three example nodes of the simple linked list used in the program linklist.c. The dData field contains a double precision value,

```

/*****
 * Filename: LinkList.c
 * Description: Simple Linked List Demo
 * (c) 1998 Jeff Stefan
 */
#include <stdio.h>
#include <dos.h>
#include <math.h>
#include <malloc.h>
#include <memory.h>
#include <conio.h>
#include "linklist.h"

#define SUCCESS 0
#define FAILURE 1
#define MAX_FILE_NAME 45

void CreateLst(void);
void AddNode(double);
void SearchLst(int);

int OpenFile(char *);
void CloseFile(void);
void ReadFile(char *);
void CloseFile(void);
void CalcAve(void);

/*****
 * list declaration and pointers,
 * and global var to count number
 * of list nodes.
 *****/
struct lSt *First,*Node,*SrchPtr;
int NumListEntries;

/*****
 * declare statistics structure
 *****/
struct stats Stat;

/*****
 * file pointer
 *****/
FILE *fp;

void main(int argc,char *argv[])
{
    int i;
    int Result;
    char Filename[MAX_FILE_NAME];

    /*****
     * Read filename from the command line then open file.
     *****/
    if(argc < 2)
    {
        printf("No filename specified...\n");
        exit(0);
    }
    strcpy(Filename,argv[1]);

    fp = fopen(Filename,"r");
    if(fp == NULL)
    {
        printf("Cannot open input file.\n");
        exit(0);
    }

    /*****
     * Create the linked list, read a data file into the list,
     * then close the data file.
     *****/
    CreateLst();
    ReadFile(Filename);
    CloseFile();
}

```

```

* Calc the average and standard deviation of the
* data held in the list.
*****/
CalcAve();

/*****
 * Print results
 *****/
printf("Data file:  %s\n",Filename);
printf("Average is:  %4.3f\n",Stat.Ave);
}

/*****
 * CreateLst : creates linked list
 *****/
void CreateLst()
{
    First = malloc (sizeof (struct lSt));
    if(First == NULL)
    {
        printf("Can't malloc list\n");
        exit(0);
    }

    Node = First;
    Node->Nxt = NULL;
}

/*****
 * AddNode: adds a node to the list
 *****/
void AddNode(double nNewData)
{
    Node->dData = nNewData;
    Node->Nxt = malloc(sizeof(struct lSt));
    if(Node->Nxt == NULL)
    {
        printf("Malloc failure in AddNode()\n");
        exit(0);
    }
    Node = Node->Nxt;
    Node->Nxt = NULL;
}

/*****
 * SearchLst: searches list for data
 *****/
void SearchLst(int SrchData)
{
    /*****
     * point to first element of list
     *****/
    SrchPtr = First;
    while(SrchPtr)
    {
        if(SrchPtr->dData == SrchData)
        {
            printf("Data found\n");
            break;
        }
        SrchPtr=SrchPtr->Nxt;
    }
    if(SrchPtr == NULL)
    {
        printf("Data not found\n");
    }
}

/*****
 * OpenFile: opens data file from cmd line input
 *****/
int OpenFile(char FName[])
{
    char TmpName[MAX_FILE_NAME];
}

```

```

if(fp=fopen(Fname,"r") == NULL)
{
    printf("Cannot open input file.\n");
    return(FAILURE);
}
else
{
    return(SUCCESS);
}

/*****
 * CloseFile: closes an opened file
 *****/
void CloseFile()
{
    if(fp)
    {
        close(fp);
    }
}

/*****
 * ReadFile: reads a data input file
 *****/
void ReadFile(char *Fname)
{
    char TmpVal[15];
    double DataVal;
    int Done = 0;

    NumListEntries = 0;
    while(!Done)
    {
        /*****
         * read data as string and convert to double
         *****/
        if(fscanf(fp,"%s",TmpVal)!=EOF)
        {
            Done = 0;
            DataVal = atof(TmpVal);
            /*****
             * load linked list
             *****/
            AddNode(DataVal);
            NumListEntries++;
        }
        else
            Done = 1;
    }
}

/*****
 * CalcAve: calculates average from data stored in
 * linked list and stores in Stat structure.
 *****/
void CalcAve(void)
{
    double TmpSum;
    double TmpAve;

    /*****
     * reset list ptr
     *****/
    Node = First;

    /*****
     * get sum of data in linked list
     *****/
    TmpSum=0;
    while(Node->Nxt)
    {
        TmpSum = TmpSum + Node->dData;
        Node=Node->Nxt;
    }

    /*****
     * calculate average
     *****/
    TmpAve = TmpSum/NumListEntries;

    /*****
     * load in list structure
     *****/
    Stat.Ave = TmpAve;
}

```


and the *Nxt pointer is used to link the list together. When the *Nxt pointer is NULL, indicated by the electrical ground signal, there are no more elements in the list.

The first thing to be done in the main program linklist.c is to declare pointers to the list structure. Linklist.c uses three global pointers, *First, *Node, and *SrcPtr. The pointer *First will point to the first instance of the list structure, or first node. This first node acts as an anchor, so we give it an exclusive pointer and will not change its address. For each new node in the list, we use the *Node pointer. If we want to search for a specific value that's in one of the list nodes, we use the *SrcPtr.

The next thing to do is to create the list. The function CreateList() makes a call to malloc() to create a linked list. The call is:

```
First = malloc(sizeof (struct lst));
if (First == NULL)
{
    printf ("Can't malloc list\n");
    exit( 0);
}
Node = First;
Node->Nxt = NULL;
```

We simply ask the compiler for the number of bytes to store a lst structure, no more, no less. That's why we use the sizeof operator. This tells the compiler to generate the instructions to calculate the exact number of bytes it takes to store the lst structure. Now that the first node is allocated, we initialize the list pointers by pointing the current list element *Node to *First. Notice that we're dealing with addresses, not data, so there is no star operator attached to *Node or *First in the code. We then set the *Nxt pointer to NULL, indicating there are no more nodes in the list (we've just allocated our first list element only).

The hard part is over after the first node is allocated. The first node is safely allocated in memory, the list pointers are initialized, and we're ready to add more nodes when we need to. To illustrate how lists are built, linklist.c reads a file of numbers, D1.dat, into the list,

then calculates the average of the numbers. The ReadFile() function makes a call to AddNode(). The code for AddNode() is:

```
AddNode(double nNewData)
{
    Node->dData = nNewData;
    Node->Nxt = malloc( sizeof (struct lst));
    if (Node->Nxt == NULL)
    {
        printf ("Malloc failure in AddNode( )\n");
        exit(0);
    }
    Node = Node->Nxt;
    Node->Nxt = NULL;
}
```

AddNode() loads the data read from the file into the dData list field and allocates storage for the next node. The last two lines look confusing, but they're not, really! Think of the *Nxt pointer as an agent that goes out and acquires new memory (this is the call to Node->Nxt = malloc()). If *Nxt is successful, then the current node is set to the newly acquired memory, via Node = Node->Nxt. The *Nxt pointer now needs to point to NULL, to let functions like SrcList() know where the end of the list is.

The function CalcAve() shows you how to reset and manipulate a linked list. The first thing that happens in CalcAve() is to set the current list element *Node equal to the first element of the

list, *First. We'll be traversing the list from beginning to end and adding the dData values, so we need to know where the list starts. When we first created the list, we allocated the base node called *First and then left it alone. Remember, *First acts as an anchor that always points to the beginning of the list. The next block of code traverses the list and adds the data values:

```
while (Node->Nxt)
{
    TmpSum = TmpSum + Node->dData;
    Node=Node->Nxt;
}
```

While the *Nxt pointer isn't NULL (at the end of the list), we'll keep accessing the data field in the list and adding them together. That's why we set Node->Nxt equal to NULL whenever a new node is allocated. If the *Nxt pointer wasn't set to NULL, then the while loop wouldn't know where the end of the list was and the program would either crash or hang up. After the list is read and the numbers are summed, their average is calculated and placed in the stats structure element Stat.Ave.

I know this is a lot to learn, and dealing with dynamic memory allocation and linked lists can be confusing and intimidating, but if you want to elevate your programming skills and gain complete control over your computer's resources, you need to master these two areas. Sometimes looking at things from a compiler's viewpoint helps. The code is yours to experiment with. I compiled it with Turbo C/C++ 3.0, but any ANSI C compiler should work. Add new pointers and variables to cpoint.c and see what happens. Try modifying linklist.c to make a call to SrcList() and single step through the code with a debugger to see what happens.

In programming, you learn by doing, not just reading through code listings. Use this code base to create lists you can use in your own programs. Above all, don't give up and revert back to using arrays and arrays of structures for everything. It's like driving a Pinto when you could be driving a Porsche. **NV**

```
/* *****
 * Filename: LinkList.h
 * Description: Linked list data structure for linklist.c
 * (c) 1998 Jeff Stefan
 * *****
 */
/* *****
 * Linked list structure
 * *****
 */
struct lst
{
    double dData;
    struct lst *Nxt;
};
/* *****
 * statistics structure
 * *****
 */
struct stats
{
    double Ave;
};
```



Subscribe Today!

Call 800 783-4624
http://www.nutsvolts.com

**Robotics
Lasers
Communications
Computers
Microcontrollers
Automation
Alternative Energy
Much More!**

**Only
\$19 for
12
issues!**

**Nuts & Volts
Magazine**

**Exploring Electronics
And Technology
For The Hobbyist
And Professional**

HOW TO PLACE A CLASSIFIED AD

TYPE or PRINT your **ELECTRONICALLY RELATED** ad copy **CLEARLY (not all caps)** on a separate piece of paper. Spell out words when submitting handwritten copy. Calculate the number of words and multiply it by the appropriate rate (see RATE PER WORD section). Include any charges for **bold** and/or **CAPPED** words, any artwork costs that would be applicable, and/or costs for boxing your ad (explained below). Choose the appropriate classification for your ad(s) to appear in (see below). If no classification is indicated, it will be placed in Misc. Electronics or wherever we deem most suitable. **Enclose your name, address, phone number, and Nuts & Volts account number from your mailing label** (if available) for identification purposes. Include full payment — **CLASSIFIEDS RUN ON A PRE-PAID BASIS ONLY** — and mail your completed order to:

NUTS & VOLTS MAGAZINE, 430 Princeland Ct., Corona, CA 91719.

RATE PER WORD

The ad rate for **current PAID subscribers** is **60¢** per word. All others pay **\$1.20** per word. There is a **\$9.00 minimum** charge per ad per insertion.

WORDS IN BOLD AND/OR ALL CAPS

Words to be set in **bold** or **CAPS** are each **10¢** extra PER WORD. **BOLD CAPS** are **20¢** extra per word. The first two words of each ad are bold capped at no charge. Indicate bold words by underlining. Words normally written in caps (e.g., IBM) and accepted abbreviations such as VAC or MHz are NOT charged as all cap words. Use a two-letter abbreviation for states.

PHOTOS, DRAWINGS, AND BOXES

A photo or drawing may be run at the top of your classified ad for an additional **\$10.00** (1" depth max.) for camera-ready art. No wording is allowed in this area. Add a one-time charge of **\$5.00** to enlarge, reduce, or duplicate line art,

or **\$8.00** for halftone of photographs. To **BOX** your ad, include an additional **\$50.00** for copy-only ads, or **\$75.00** for ads with art or photos.

FAXING IN AD COPY

You may fax in ad copy or changes before the closing date (5:00pm on the **5th**) at 909-371-3052 using MasterCard or Visa. Include credit card expiration date, the name that appears on the card, a daytime phone number, and your Nuts & Volts account number. Ads without credit card information will not be listed as received until payment is received in full. **WE DO NOT CALL OR FAX BACK VERIFICATION OR QUOTES OF FAXED-IN ADS.** For verification of faxed-in ads, please call 909-371-8497.

DEADLINE

Prepaid ads received by 5:00pm on the **closing date (5th of the month)** will appear in the following month's issue. Ads postmarked through the **5th**, but received after the closing date, will be placed in the next available issue. No cancellations or changes after the 5th. Cancellations and changes must be submitted in writing.

IMPORTANT INFORMATION

All classified ads are running copy only. No special positioning, centering, dot leaders, extra space, etc. is allowed. All advertising in Nuts & Volts is limited to **electronically related items ONLY**. All ads are subject to approval by the publisher. We reserve the right to reject or edit any ad submitted. We do not take ad copy or changes over the phone. We do not bill for classified ads. Repeat ads or ads run in multiple classifications within the same issue are allowed. Paid subscribers may run ads at the 60¢ rate only through their subscription expiration date. **NO REFUNDS.** Credit only. No credit for typesetting errors will be issued unless you *clearly* print or type your ad copy.

Choose a category for your ad from the classifications listed below.

- | | | | |
|-------------------------------|----------------------------------|----------------------------|---------------------------------|
| 10. Ham Gear For Sale | 80. Test Equipment | 120. Components | 155. Manuals/Schematics Wanted |
| 20. Ham Gear Wanted | 85. Security | 125. Microcontrollers | 160. Misc. Electronics For Sale |
| 30. CB/Scanners | 90. Satellite Equipment | 130. Antique Electronics | 170. Misc. Electronics Wanted |
| 40. Music & Accessories | 95. Military Surplus Electronics | 135. Aviation Electronics | 175. BBS & Online Services |
| 50. Computer Hardware | 100. Audio/Video/Lasers | 140. Publications | 180. Education |
| 60. Computer Software | 110. Cable TV | 145. Robotics | 190. Business Opportunities |
| 70. Computer Equipment Wanted | 115. Telephone/Fax | 150. Plans/Kits/Schematics | 200. Repairs/Service |

ADVERTISER'S INDEX

Abacom Technologies	81	Cunard Associates	30	Jade Products, Inc.	76	Seabird Technical	77
ABC Electronics	65	Cyber-Test	28	James' Electronic Services, Ltd.	79	SGC	65
Ace Computers	61	Danbar Sales Company	43	KDE Electronics Corp.	75	Shreve Systems	76
ACP Super Store	18	Davilyn Corp.	101	KD Video	16	SIMCO	55
Active Industries	10	Detection Dynamics	77	Kimtronix	54	Sinaco Electronics	76
Advanced Educational Systems	13	Dexis	34, 77	La Paz Electronics Int'l.	64	Skycraft Parts & Surplus, Inc.	80
Alfa Electronics	54	DYNAMIC Technologies	86	Linear Systems	13	Software Buy Mail	76, 77
All Electronics Corporation	46	Earth Computer Technologies	62	M2L Electronics	34	Spy Outlet	76
Allison Technology Corporation	63, 76	E.H. Yost & Co.	85	Manu Industries, Inc.	51	Square 1 Electronics	29
Alltech Electronics	19	ELECTRO MAVIN	84	Metric Equipment Sales, Inc.	58	Sun Equipment Corporation	44
Alltronics	94	Electro Tool, Inc.	51	Metro Surplus	64	Surplus Traders	76
American Innovations, Inc.	68	Electronic Design Specialists, Inc.	60	microEngineering Labs	23	Synergetics	78
AM Research, Inc.	29	Electronic Goldmine	20	Micromint	30	TechAmerica	15
ANA Instruments	49	Electronic Rainbow Ind., Inc.	45	Midwest Electronics	59	Techniks, Inc.	76
Andromeda Research	16	Electronix Express	65	MING	77	Technological Arts	76
Antique Radio Classified	77	EMAC, Inc.	28	Modern Communications	21	Televue Distributors	52
Ar2 Communications Products	87	Equipment Management Technology	8	Modern Electronics	80	Test Equipment Plus	69
AST Global Electronics	67	EPS	77	Motron Electronics	10	The RF Connection	24
Basic Electrical Supply		Fair Radio Sales	81	Netcom	22	The Soundsmith Corp.	42
& Warehousing Corporation	58	Far Mountain Corp.	100	One Stop Supplier	100	Timeless Products	70
Baylin Publications	9	Foss Warehouse Distributors	76	Optoelectronics	103	Timeline, Inc.	55
BCD Electro	76	Gateway Electronics, Inc.	50	Parallax, Inc.	4, Back Cover	T.T.I.	77
Bell Electronics	66	General Device Instruments	76	PARAMAX, INC.	39	Unicorn Electronics	75
Bilocon Corp.	77	General Science & Engineering	9	Phelps Instruments	37	USI Corp.	31
Bisme Computers Outlet	70	Gillian Technologies, Inc.	102	Pioneer Hill Software	60	Utopia Tools	102
Brigar Electronics	35	Graymark	17	Polaris Industries	49	V&V Mach. & Equipment, Inc.	76, 77
Bytemark Corporation	87	Greenleaf Electronics	53	Prairie Digital, Inc.	77	VersaTech Electronics	100
C & S Sales, Inc.	12, 57	Halted Specialties Co.	3	Prime Electronic Components, Inc.	34	Viking International	78
C and H Sales Company	62	H.T. Orr Computer Supplies	64	Quality Electronics	41	Visitect, Inc.	23
Cable King	66	Intek Electronic Systems	81	R & S Surplus	33	Weeder Technologies	32
Capital Electronics, Inc.	8, 63	Index Publishing Group	41	Ramsey Electronics, Inc.	56	Western Test Systems	26-27
Chenesko Products, Inc.	18	Innovation West	76	Resources Un-Ltd.	40	White-Star Electronics	39
Communications Electronics, Inc.	48	Information Unlimited	59	R.E. Smith	76	Wholesale Cable	84
Consumertronics	38	Interactive Image Technologies, Ltd.	7	RKA Systems	14		
Corporate Systems Center	2	Intronics, Inc.	51	Roger's Systems Specialist	47		
Cruising Equipment	31	ITU Technologies	77	Scott Edwards Electronics	14		

AMATEUR RADIO & TV

Abacom Technologies	81
Alltronics	94
Communications Electronics, Inc.	48
Gateway Electronics, Inc.	50
Jade Products, Inc.	76
Ramsey Electronics, Inc.	56
SGC	65
The RF Connection	24

BATTERIES/CHARGERS

Cruising Equipment	31
Cunard Associates	30
E.H. Yost & Co.	85
Jade Products, Inc.	76

BUSINESS OPPORTUNITIES

Chenesko Products, Inc.	18
-------------------------	----

BUYING ELECTRONIC SURPLUS

ABC Electronics	65
Alltech Electronics	19
C and H Sales Company	62
Dexis	34, 77
Earth Computer Technologies	62
Equipment Management Technology	8
Metric Equipment Sales, Inc.	58
Roger's Systems Specialist	47
Skycraft Parts & Surplus, Inc.	80

CABLE TV

Active Industries	10
Basic Electrical Supply & Warehousing Corporation	58
Cable King	66
DYNAMIC Technologies	86
Foss Warehouse Distributors	76
Greenleaf Electronics	53
Intek Electronic Systems	81
James' Electronic Services, Ltd.	79
KDE Electronics Corp.	75
KD Video	16
Kimtronix	54
Metro Surplus	64
Modern Communications	21
Modern Electronics	80
One Stop Supplier	100
Quality Electronics	41
Televue Distributors	52
Timeless Products	70
White-Star Electronics	39
Wholesale Cable	84

CB/SCANNERS

Communications Electronics, Inc.	48
USI Corp.	31

CCD CAMERAS/VIDEO

American Innovations, Inc.	68
Detection Dynamics	77
Polaris Industries	49
Ramsey Electronics, Inc.	56
Resources Un-Ltd.	40
Seabird Technical	77
Spy Outlet	76
Timeline, Inc.	55
USI Corp.	31

COMPONENTS

Ace Computers	61
BCD Electro	76
Capital Electronics, Inc.	8, 63
Electronic Goldmine	20
Electronix Express	65
La Paz Electronics Int'l.	64

Linear Systems	13
MING	77
Skycraft Parts & Surplus, Inc.	80
TechAmerica	15
Unicorn Electronics	75
Visitec, Inc.	23

COMPUTER

Hardware

Ace Computers	61
ACP Super Store	18
Allison Technology Corp.	63, 76
Alltech Electronics	19
AM Research, Inc.	29
Bisme Computers Outlet	70
Bytemark Corporation	87
Consumertronics	38
Corporate Systems Center	2
Earth Computer Technologies	62
ELECTRO MAVIN	84
EPS	77
General Device Instruments	76
Halted Specialties Co.	3
Innovation West	76
La Paz Electronics Int'l.	64
Midwest Electronics	59
MING	77
Prime Electronic Components, Inc.	34
Roger's Systems Specialist	47
Shreve Systems	76
Techniks, Inc.	76
The Soundsmith Corp.	42

Software

AM Research, Inc.	29
Bisme Computers Outlet	70
Innovation West	76
Interactive Image Technologies, Ltd.	7
Pioneer Hill Software	60
Software Buy Mail	76, 77

Microcontrollers / I/O Boards

Abacom Technologies	81
Advanced Educational Systems	13
AM Research, Inc.	29
Bisme Computer Outlet	70
EMAC, Inc.	28
Far Mountain Corp.	100
Innovation West	76
ITU Technologies	77
La Paz Electronics Int'l.	64
Micromint	30
MING	77
Motron Electronics	10
Parallax, Inc.	4, Back Cover
PARAMAX, INC.	39
Prairie Digital, Inc.	77
R.E. Smith	76
Scott Edwards Electronics	14
Square 1 Electronics	29
Technological Arts	76
VersaTech Electronics	100

Printers/Printer Supplies

Chenesko Products, Inc.	18
H.T. Orr Computer Supplies	64

DESIGN/ENGINEERING SERVICES

Capital Electronics, Inc.	8, 63
SIMCO	55
V&V Mach. & Equipment, Inc.	76, 77

EDUCATION

Advanced Educational Systems	13
EMAC, Inc.	28
Far Mountain Corp.	100
Sun Equipment Corporation	44

EVENTS/SHOWS

ACP Super Store	18
-----------------	----

KITS

Alltronics	94
------------	----

C & S Sales, Inc.	12, 57
Earth Computer Technologies	62
Electronic Rainbow Ind., Inc.	45
EMAC, Inc.	28
Gateway Electronics, Inc.	50
Information Unlimited	59
Jade Products, Inc.	76
Ramsey Electronics, Inc.	56
Scott Edwards Electronics	14
USI Corp.	31
Weeder Technologies	32

LASERS

Information Unlimited	59
Resources Un-Ltd.	40
Unicorn Electronics	75

MISC./SURPLUS

All Electronics Corporation	46
Alltech Electronics	19
Brigar Electronics	35
C and H Sales Company	62
Consumertronics	38
Cyber-Test	28
Electronic Rainbow Ind., Inc.	45
Equipment Management Technology	8
Fair Radio Sales	81
Gateway Electronics, Inc.	50
General Science & Engineering	9
Halted Specialties Co.	3
Prime Electronic Components, Inc.	34
Resources Un-Ltd.	40
Shreve Systems	76
Skycraft Parts & Surplus, Inc.	80
Surplus Traders	76
Unicorn Electronics	75
Viking International	78
Visitec, Inc.	23
Weeder Technologies	32

PROGRAMMERS

Andromeda Research	16
General Device Instruments	76
Intronics, Inc.	51
M2L Electronics	34
microEngineering Labs	23
Sinaco Electronics	76

PUBLICATIONS

Antique Radio Classified	77
Consumertronics	38
Netcom	22
Square 1 Electronics	21
Synergetics	78

ROBOTICS

Abacom Technologies	81
Far Mountain Corp.	100
PARAMAX, INC.	39

SATELLITE

Baylin Publications	9
---------------------	---

SECURITY

American Innovations, Inc.	68
Gillian Technologies, Inc.	102
Information Unlimited	59
Polaris Industries	49
USI Corp.	31
Visitec, Inc.	23

SOLAR EQUIPMENT

Cruising Equipment	31
--------------------	----

FIND
what you need...
FAST
by **PRODUCT** OR **CATEGORY**

STEPPER MOTORS

Alltronics	94
PARAMAX, INC.	39

TELEPHONE

Ar2 Communications Products	87
Bilocon Corp.	77
Communications Electronics, Inc.	48
T.T.I.	77
Weeder Technologies	32

TEST EQUIPMENT

ABC Electronics	65
Alfa Electronics	54
Allison Technology Corp.	63, 76
ANA Instruments	49
AST Global Electronics	67
Bell Electronics	66
C & S Sales, Inc.	12, 57
C and H Sales Company	62
Cruising Equipment	31
Danbar Sales Company	43
Davilyn Corp.	101
Dexis	34, 77
Electronic Design Specialists	60
Equipment Management Technology	8
Electro Tool, Inc.	51
Intronics, Inc.	51
Metric Equipment Sales, Inc.	58
Optoelectronics	103
Phelps Instruments	37
Pioneer Hill Software	60
R & S Surplus	33
RKA Systems	14
Seabird Technical	77
Soundsmith	42
Sun Equipment Corporation	44
TechAmerica	15
Test Equipment Plus	69
Western Test Systems	26-27

TOOLS

C & S Sales, Inc.	12, 57
Electro Tool, Inc.	51
Graymark	17
Intronics, Inc.	51
Sun Equipment Corporation	44
The RF Connection	24
Utopia Tools	102
White-Star Electronics	39

WIRE/CABLE & CONNECTORS

Manu Industries, Inc.	51
Roger's Systems Specialist	47
The RF Connection	24

COMPUTER CASE & POWER SUPPLY

Mini tower case with power supply, two 5.25" and two 3.5" external bays, plus one internal bay for hard drive. LEDs for power, turbo and HDD. Standard or PS2 keyboard and mouse connector opening.



BASIC PARALLEL CABLE FOR pcANYWHERE

Six-ft. "competition yellow" DB-25M to DB-25M laplink cable.

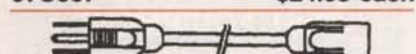
98W005 \$5.95 each



SINGLE-BOARD COMPUTER With 7-Slot Backplane

Intel 12.5 MHz 80L286 CPU, 1MB of SIMM RAM installed (expandable to 4MB). AMI BIOS. DOS/Windows 3.1 compatible. Programmable clock/calendar with internal battery backup. Three timer channels. Seven DMA channels and 16 levels of vectored interrupts. Supports IBM compatible keyboards, external keylock, and speaker. Low power consumption. Comes with 7-slot ISA bus passive backplane (mounts like Baby AT mother-board), and documentation. Use as dedicated process controller or as super low cost AT computer.

97C007 \$24.95 each



IEC LINE CORD

Six feet long. NEMA 5-15P to IEC female.

95W011 Special \$1.00 each



FLOPPY DRIVE STEPPER MOTOR

0.9°/step. 1.5" square x 0.625" thick, not including the shaft. Manufactured for use in floppy drives.

94M003 \$7.95 each

UNIPOLAR STEPPER MOTOR DRIVER IC

UCN5804. Drives a unipolar stepper in one of three operating modes: single phase, two phase or half step. Up to 1.25 Amps per phase. Step and direction input. Drive with a 555 timer, parallel port, etc. Build your own robot, anything that requires precision positioning.

93I002 \$4.50 each

NIPPON PULSE MOTOR

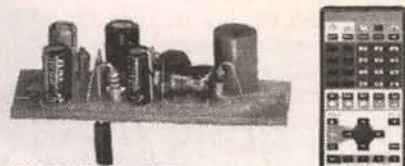
7.5 deg./step, 48 s/rev, 5 V, stepper with brass gear mounted on shaft. NPM P/N PF42-48ES. With spec sheet.

92M010 \$3.95 each

COMBO PACK!

One 93I002 IC and 92M010 motor (both shown above) with schematics.

93I003 \$7.95/set



INFRARED KIT

Includes assembled transmitter unit with forty-seven buttons (97V012), detector unit, printed circuit board, detector amplifier IC, and all parts needed to detect the signal from the transmitter and convert it to a serial TTL signal.

93V010 \$19.95 each

1000 FT RG59/U CABLE

Copper braid, solid center conductor.

98W003 \$79.95

486 CPU'S

Limited to stock on hand!

486SX-20 \$8.00 each

486SX-25 \$10.00 each

486DX-50 \$25.00 each

486DX2-50 \$20.00 each

486DX2-66 \$35.00 each

486DX4-100 \$50.00 each

PENTIUM-66 \$35.00 each

SOLENOID RELAY

Intermittent duty, 6VDC, 2 Ohm coil resistance.

98B006 \$1.95



50-LB. CARE PACKAGE

Surplus goodies from Silicon Valley. This is not junk, just material we've acquired in quantities too small to catalog - electronic and mechanical subassemblies for everything from robots to rockets. Assortments may include ICs, caps, connectors, bearings, diodes, hardware, circuit boards, cables. Weird and wonderful stuff. Most folks are happy with the assortments we send and we often get re-orders. Try one.

92U034 50 Lbs. for \$49.95

ECOHEAT™ HEAT GUN

An economical, lightweight, multi-use heat gun with two heat settings (500° and 1000°F). Has 3-position slide switch, built-in hand guard, 3-wire grounded cord, thermoplastic case. UL listed, 120VAC.

EC-100 \$32.95 each



PENTIUM HEATSINK FAN

Flexible grip makes sure heat sink and fan touch the CPU for best cooling.

97C050 \$5.75 each



INTERNAL TV A-B SWITCH

12VDC @ 15mA controls relay. Specs included.

98G001 \$7.95 each



ULTRABRIGHT WHITE LED

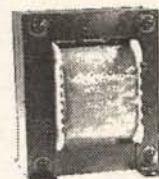
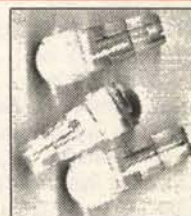
T1-3/4, water clear, 1600 mCd. Docs included.

SE5082H \$4.95 each

LIGHT AMPLIFIER???

This clear 5/16" diameter plastic lens fits nicely on a T1 LED or the end of a fiberoptic cable and magnifies the output.

98L004 Four for \$1.00



8Hy 300mA CHOKE

800 Ohms DCR, 3000V RMS insulation. Stancor #C-1722.

98N003 \$9.95

TOROID CORE ASSORTMENT

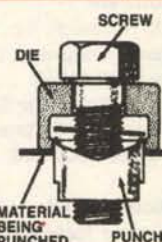
WOW! May contain tape wound, powdered metal, ferrite material cores, different sizes.

92N016 20 for \$4.95

GREENLEE RADIO CHASSIS PUNCH

#730-9/16" dia.

97Z018 \$9.95



Studioline Stereotrack II Cable TV Adapter

Separates stereo signals from the cable TV input, feeds RF signals to TV/VCR tuner and stereo signals to FM (either RF or fixed/variable level audio). Hundreds of useful parts which may be removed for audio/RF projects. Controller board has CPU and socketed EPROM as well as Mitsumi varactor tuner, cable/FM separator board, regulated power supply subassembly, channel select board, and stereo separation output board. Black metal case, 14" x 10" x 3". Sold for experimental purposes only. With documentation.

92V020 Two for \$39.95



TV AUDIO DEMODULATOR

Unused unit from cable TV box takes channel 3, 4 or 5 signal and demodulates the audio. Comes with documentation and schematics, plus additional schematics to build add-on video demodulator board.

92A028 \$9.95 each

12.6V @ 92A MAXI SWITCHERS

200-250VAC in. Plug & play, no minimum load. With docs.

98E009 \$79.95 each

* Same as above, except 5V @ 192A out. 98E010 \$24.95 each



MINI-SWITCHER

Input: 100-250VAC or 120-300VDC. Output: -5V @ 8A; +12V @ 3.5A; -12V @ 1A. Size 3"D x 5"W x 1.75"H. Output connections: 1 x MBD; 2 x Drive; 1 x Mini Drive. Suitable for computers with up to three drives.

98E006 \$7.95 each



PLUG & PLAY IDE CD-ROM INTERFACE CARD

Supports up to two ATAPI compliant IDE CD-ROM drives.

98C007 Box of 20 for \$19.95



MULTI-OUTPUT TRANSFORMER

110V primary, two 18.2VAC secondaries, one center-tapped 20VAC secondary. With schematic.

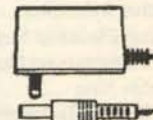
98E002 \$4.95 each



9VDC 1A WALL WART

Input 120VAC, 60Hz, 16W. Class 2. Center negative coaxial connector.

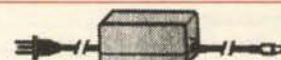
98E004 \$5.95



16.5VCT 1.5A DESK POWER SUPPLY

115VAC in; AC output 16.5 VCT @ 1.5A.

97E009 \$4.95 each



MINI TOWER POWER SUPPLY

Pulled from unused equipment.

96C009 \$9.95 each



ATARI 1020 COLOR PRINTER

For all Atari 8-bit computers. (Not PC-compatible!) Package includes: printer, power supply, software, pens, paper and interface cable. These are new units in factory sealed boxes.

94C037 \$14.95 each



ALLTRONICS

2300-D Zanker Road - San Jose, CA 95131-1114

World Wide Web: <http://www.alltronic.com>

(408) 943-9773 - Fax (408) 943-9776

Store Hours: 9-6 M-F & 10-3 Sat. - Pacific Visa, M/C, AmEx Accepted.

All Sales Final.

California Residents Add Sales Tax.

Shipping Additional on All Orders.

Prices Good 60 Days from Date of Publication



Send \$2.00 For Our Latest Catalog!

\$4.00 Foreign. Refundable on First Order.

010598

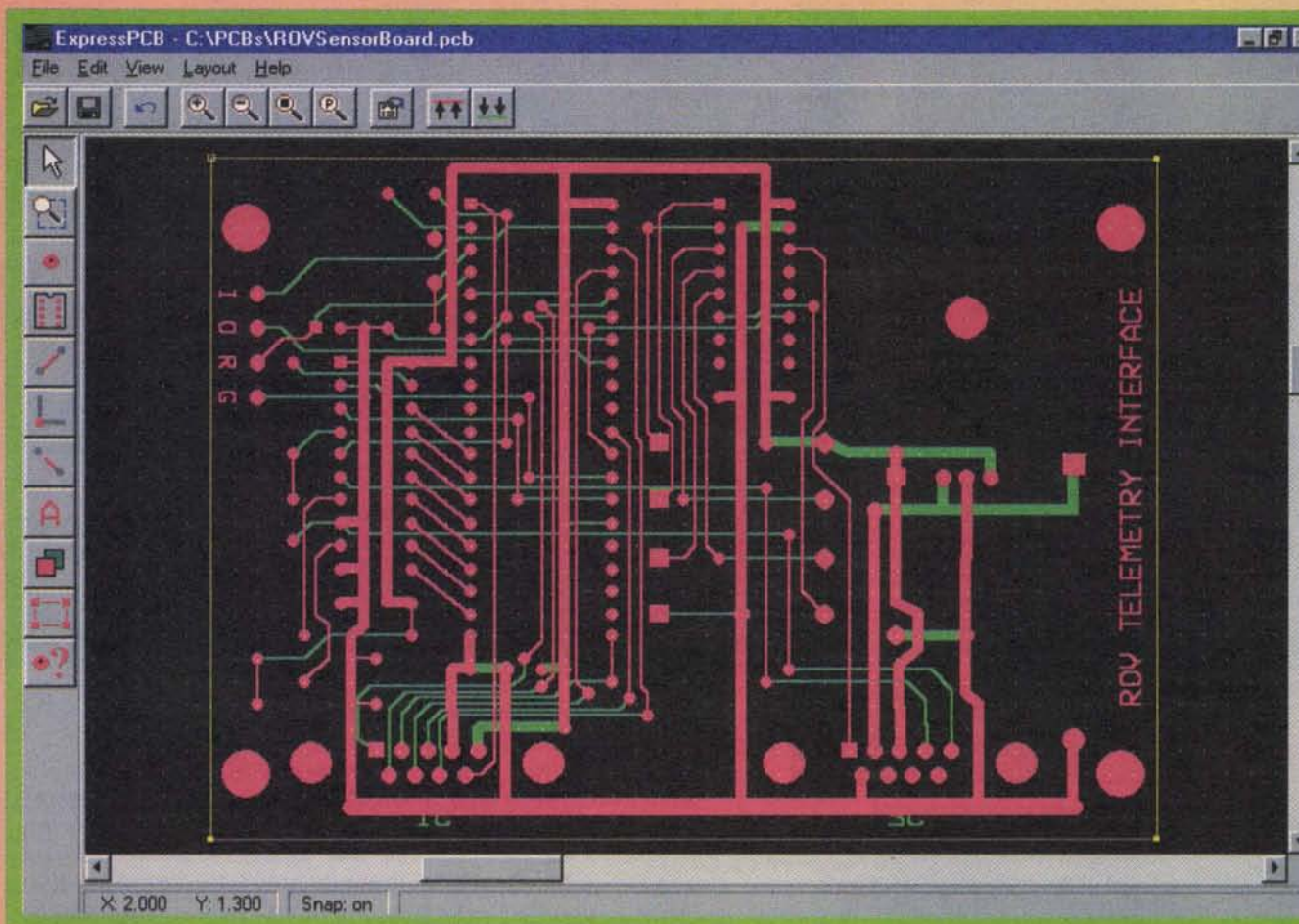


Figure 1. Graphical user interface for ExpressPCB's layout program.

plated-through holes are clearly the ticket for prototyping modestly complicated circuits; the only other thing you need is a few tricks of PC board design.

The Standard Recipe

The first step is easy enough: you launch the layout program (see Figure 1) and establish the physical outline of the board by dragging on

Contrary to popular belief, prototyping with printed circuit boards can be inexpensive and hassle-free.

the corner of the default rectangle displayed in the main window. That act automatically establishes two grids of fiducial points.

One of these sets makes up the so-called visible grid — helpful benchmarks arrayed a tenth of an inch (0.100") apart — which is, of course, a convenient spacing for

Most hobbyists with an interest in electronics, and indeed many professionals who are not full-time electrical engineers, routinely use wire-wrapped boards to prototype circuits, even though these boards look rather messy and prove a nuisance when it comes time to make multiple copies. What to do? The obvious answer is to do what the pros do: use printed circuit boards.

Yet few follow this route, because they perceive too many barriers to making PC boards themselves. Creating the artwork for a board is the first roadblock.

Pre-printed stick-on pads and slim rolls of tape promise to be frustratingly tedious. General-purpose computer drawing programs are better; although they too prove rather inflexible and difficult to apply to the task.

Specialized "CAD" PC board layout programs are clearly the way to go, but this professional-quality software is usually expensive and hard to learn.

Cheaper programs are available for a few hundred dollars, but often they prove awkward to use. For example, many of the applications available for laying out PC boards still run under DOS rather than Windows.

If all these difficulties do not dissuade you from trying to design a sleek circuit board for your next project, the challenge of negotiating a reasonable price with your local PC board fabrication shop probably will.

So thank heaven for ExpressPCB. This combi-

**by David Schneider
and Stanley Reifel**

Printed Circuit Boards for Everyone

nation software provider and PC board manufacturer will help you avoid the problems that usually arise in prototyping. Not only can you download ExpressPCB's great little layout program from www.expresspcb.com for free, once you've designed your masterpiece with it, you can order the board over the Internet with a few clicks of the mouse. What is more, you receive the finished product within a few days — all for a price that is, typically, less than \$100.00. So one no longer has to be a professional electrical engineer (or have a professional's budget) to get high-quality PC boards on demand.

To test the promise of ExpressPCB, we decided to redesign a circuit we had previously built using wire-wrap for an unusual hobby project: a home-brew underwater robot (see sidebar). This circuit board seemed a particularly good candidate for replacement, because it is housed behind an acrylic dome along with the diminutive submarine's video camera, making the wire-wrapped board a visible eyesore in what otherwise was a reasonably spiffy gadget.

Although this particular circuit isn't very complex, the boards gen-

erated by ExpressPCB can handle far more complicated designs. The key is that the service manufactures custom boards with traces on both sides and so-called "plated-through" holes.

Designing boards with two layers is a good compromise between having just a single layer of copper for connections — which is often too limiting — and dealing with multiple layers, which would normally be hard to justify in a prototype and would be expensive to produce in any case. So two-layer boards with

many electronic components.

There is also an invisible "snap-to" grid to guide you when making interconnections. Although you can disable this feature, having the components and traces tied to this grid helps ensure that your design remains neat and orderly.

The software also provides a convenient library of standard components, many of which are listed directly by their Digi-Key catalog numbers. Groupings of pads for custom components are also simple to create.

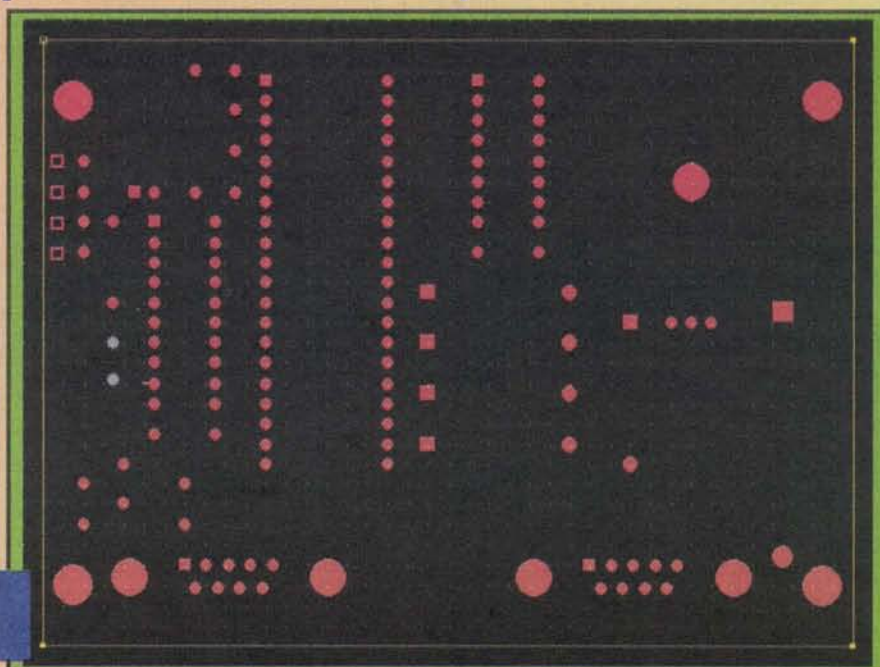


Figure 2a. Layout for telemetry controller board with components placed.

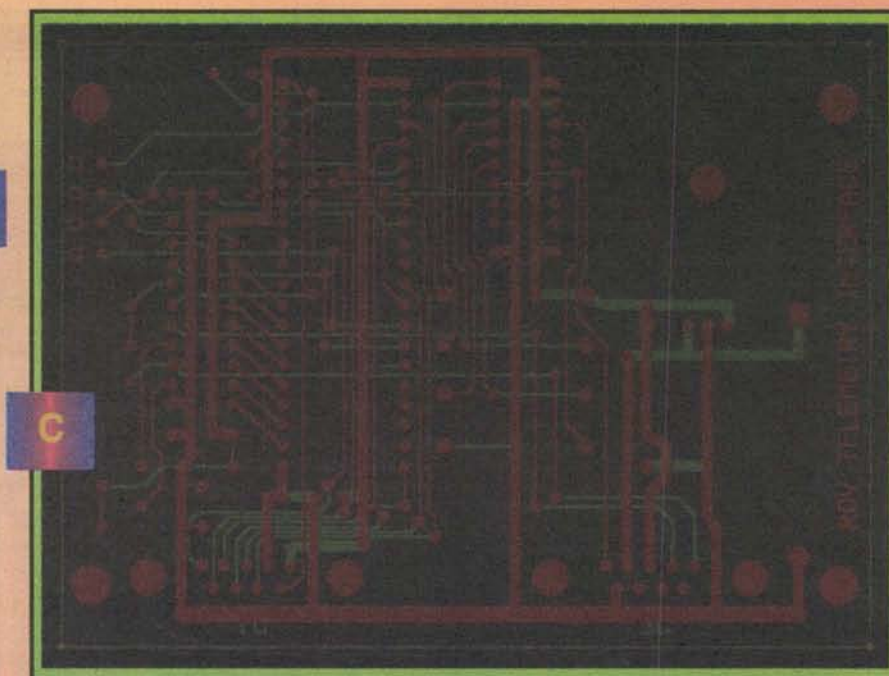
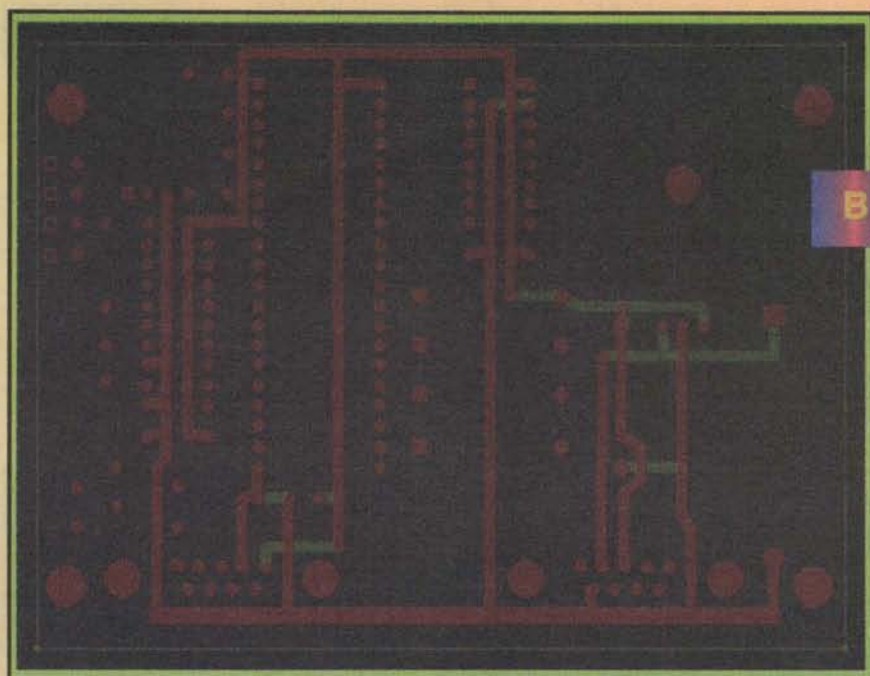


Figure 2b and 2c. Layout for telemetry controller board with components placed with power and ground traces added (b), and complete with signal traces (c).

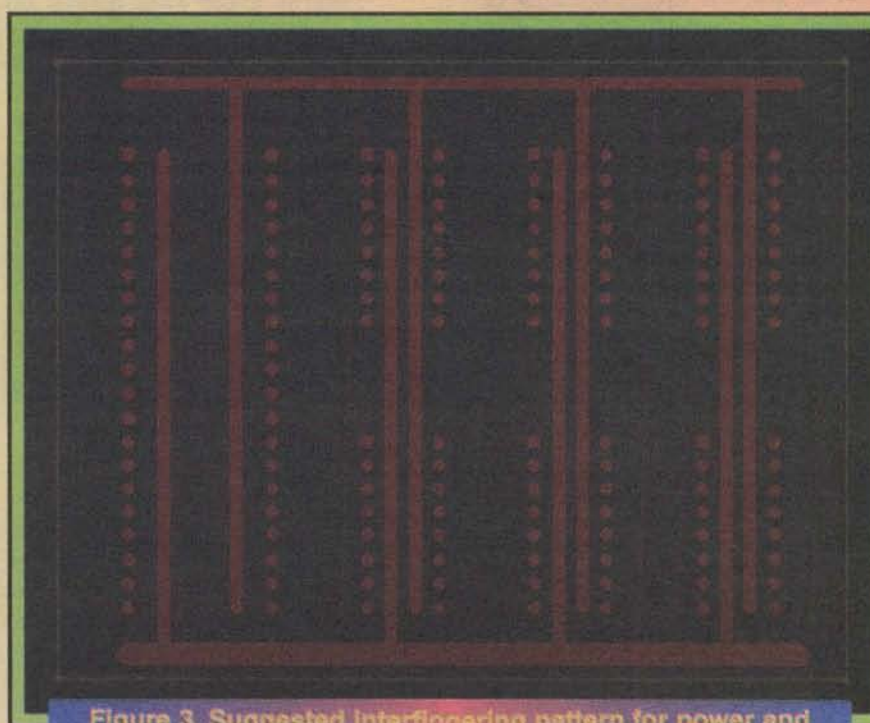


Figure 3. Suggested interfingering pattern for power and ground traces.

For example, non-standard ICs would typically require you to place a set of 0.056" holes at 0.100" spacings. And you can include other components easily enough by measuring the diameter of their leads and adding 0.008" to accommodate the copper plating that goes inside the holes.

Just don't forget to add the 0.008", or you'll be kicking yourself later when you get the board back and discover things don't fit.

With the software and a few simple guidelines, laying out the board is no big deal. You begin by considering any relevant physical constraints: What dimensions are reasonable? Where do the mounting holes go? And are there any special components, like potentiometers or connectors, that must face a certain direction?

The next task is to organize the other components, choosing to place functionally-related items

close together. But you also want to make sure you don't crowd things too much.

A good rule-of-thumb is to leave somewhere between 0.350" and 0.500" free around each of the chips. And your board will appear more professional if you keep components facing the same direction, say, with pin 1 of ICs and the positive lead of polarized capacitors always up or to the left on screen.

For our board, laying out the components took no time at all (see Figure 2a). It's a good idea to print a copy of your board at this early stage and put the components on the paper board, just to check that everything fits properly.

Once you've placed the components, the next job is to lay traces. Here is where you discover the beauty of two-

layer boards. With two layers, you can amass quite a few components and still manage to connect everything that needs to be connected. The trick is to reserve one layer for traces that run along the length of the board, the other layer for traces that run across the width. (On your computer screen, one set will go horizontally, the other vertically.)

Although this approach might seem limiting at first blush, it really isn't, because the two sides of the board can be easily connected using so-called "vias." These convenient bridges are formed by placing holes strategically: the holes are plated inside with copper, so they conduct between layers.

The combination of vias and perpendicular traces on opposite sides thus allows you to run connections as needed, all over the board.

Of course, you don't want to go putting down traces willy-nilly. Instead, start by establishing an organized set of paths for power and ground. For most digital circuits, you'll probably want to use moderately wide traces to handle the current: a 0.050" swath of cop-

per for power and at least as much, if not a bit more, for ground.

A good scheme is to run an interfingering pattern for power and ground traces (see Figure 3). Part of the network shown obviously breaks the rule about keeping traces running only in one direction on each side. But notice that the "wrong-way" traces appear only at the borders of the board, where they can't interfere with the routing of other traces.

After you have suitably distributed power and ground (Figure 2b), next connect the various signal traces. For that, a width of 0.012" should serve well.

Interconnecting signal traces between the two layers calls for a via with a pad of 0.056" (0.035" hole). Note also that these slim signal traces are apt to cause problems if you put in abrupt 90° turns: the manufacturing process tends to round corners slightly; so such traces would narrow too much while turning a sharp corner.

Avoid that possibility by substituting two closely-spaced 45° jogs where you want a signal trace to turn at right angles (see our completed layout in Figure 2c).

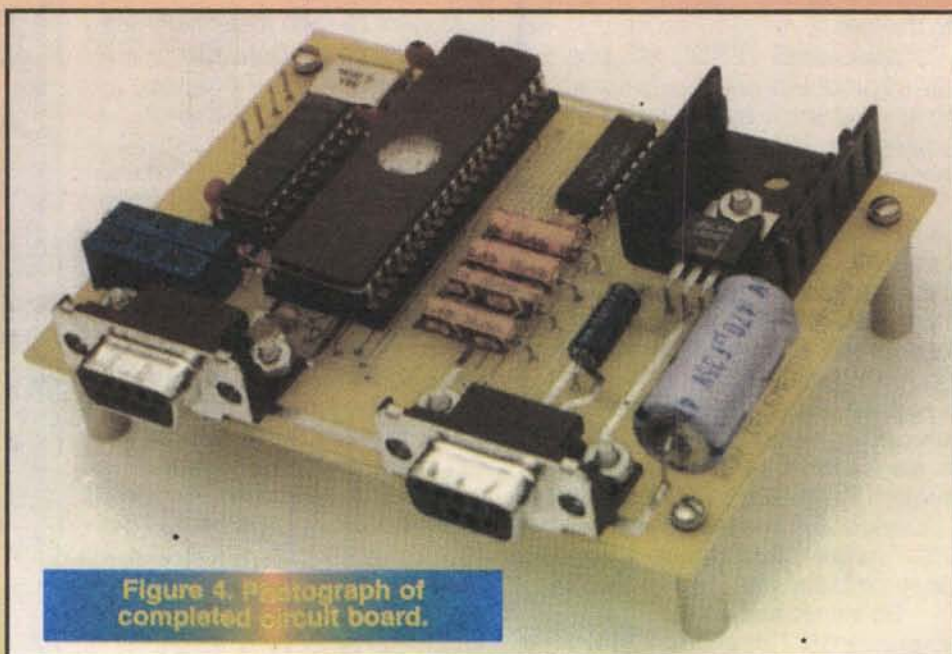


Figure 4. Photograph of completed circuit board.

Show Itemized Costs

The costs for ExpressPCB to manufacture and deliver this order will be:

Setup fee per order:	\$55.00
Setup fee for 2 boards:	\$1.00
Area cost for 24.00 square inches:	\$17.04
Shipping:	\$7.47

Total cost of order: \$80.51

Order Boards Via the Internet...

The order form is now complete. If you place the order, your credit card will be billed \$80.51 (US dollars) by "Engineering Express" to manufacture and deliver these PC boards.

Press the "Show costs itemized" button to see the costs broken down.

Show costs itemized...

Your order requires 1 full business day for manufacturing, and 2 business days for shipping. If the order is submitted after 6PM EST, or if submitted Friday night, Saturday or Sunday, then add one additional business day for manufacturing.

Before continuing, make sure your computer is connected to the Internet via your provider. Press the SEND button to place the order.

< Back

SEND

Cancel

Figure 5. Dialog box showing cost of finished PC board.

see whether you can rework your design slightly to eliminate unnecessary vias. You may also want to add text to the board at this stage, which will be helpful later, if only to mark which side is the top.

Next, you should print out the top layer of your board to check for some common problems. For instance, you can check for missing vias, which will be obvious from any traces that seem to go nowhere. Look also for traces located where they really shouldn't be (for instance, right under a metal heatsink).

If all is well, make your final check of the connections by comparing the top and bottom layers on screen to your schematic. Going over the connections on the schematic with a red pen as you follow them around your screen is a handy way to document that you've checked each and every lead.

Money Matters

ExpressPCB charges a fixed set-up fee of \$55.00 plus 71 cents for each square inch of board. (There's also a charge of 50 cents for trimming each board.) In rare instances, you may also incur an additional fee if your design involves more than 25 holes per square inch of board.

To take a concrete example,

the board we designed for the underwater robot measures three inches by four inches, and has 181 holes (see Figure 4). So having two copies of this 12-square-inch board manufactured cost \$55.00 (set-up), plus \$1.00 (trimming), plus \$17.04 (area charge), plus \$7.47 for shipping by two-day UPS. The total was just \$80.51. Although the calculation is not hard to do, a convenient feature of the software for ExpressPCB is its ability to determine the final cost to have the board made up and delivered (see Figure 5).

The software is also adept at communicating your design specifications and handling the financial transaction. All you need is a connection to the Internet. The program takes your design file and credit card information and sends this all off (encrypted) to ExpressPCB.

Within a few hours, you get confirmation of your order by E-Mail. Depending on whether you specify overnight or two-day delivery, the board will arrive at your home within two or three business days. So not only is this Internet-based service inexpensive; it's extraordinarily convenient.

If you want to give it a try for your next prototype, check out the World Wide Web Site www.expresspcb.com, where you'll find an overview of the service and instructions to download the software. **NV**

Diving without a Mask, Fins, or Snorkel

Having collaborated on quite a few strange hobby projects over the years, the construction of an underwater remotely operated vehicle (ROV) seemed a natural way for us to get into diving — without getting wet.

Such ROVs can probe underwater sites that are too deep (or too dangerous) to explore in person. The fact that one of us had some experience with mobile robots and the other had worked with oceanographic gear also encouraged the undertaking.

The completion of the project also owes a great deal to the aid of a more serious robot designer and frequent contributor to these pages — Jeff Kerr — who lent advice, moral support and a garage filled with machine tools.

This robot sub is constructed — like many research-grade oceanographic instruments — primarily of PVC plastic, 6061

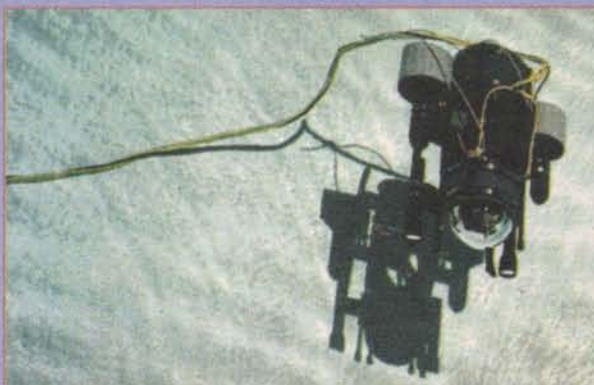


alloy aluminum, and stainless steel. The fore and aft pressure housings (fashioned from a pair of Schedule-80 PVC pipe end caps) are affixed to an anodized aluminum frame using stainless steel hose clamps.

Two underwater "thrusters" (modified trolling motors) are bolted outboard; a third hangs vertically between the two pressure housings. Skids, an acrylic dome, and a couple of pounds of lead ballast complete the basic vessel.

Although the sub's tether is 125 feet long, trials so far have been limited to swimming pools and one sheltered Atlantic inlet where the robot followed two scuba divers down about 20 feet.

Although most of the components should easily withstand the pressures at 10 times that depth, increasing friction on the seals around the motor shafts would progressively sap more and more power as the sub descends.

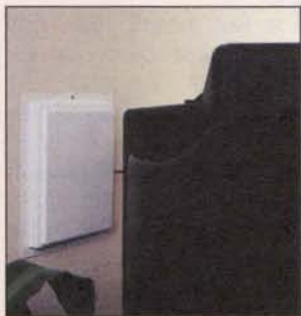




"My TV reception is so clear, you'd think I had a 50-foot antenna on my roof!"

Emerson's ingenious new antennas are hard to spot, easy to install and provide clear, powerful reception of broadcast signals...without rabbit ears.

by Hope Chapman



Replace your unsightly "rabbit ears" today!

I'm amazed at the way technology has improved television. Developments in electronic circuitry have resulted in TV sets that have sharper pictures, brilliant colors and clearer sound. From the smallest portables to wide-screen home theater systems, televisions continue to work better and better as optical innovations are introduced. Unfortunately, a television's picture is only as good as the broadcast it's receiving, and even the world's best televisions cannot make up for a weak or distorted signal. Antenna technology has not kept pace with television design, and the rabbit ears from the 1950's are not far removed from what's available today. Well, there's finally been a quantum leap in the design of antennas, and it's the result of two patented components developed by scientists. These improvements are the secret behind Emerson's revolutionary new antennas.

Picture imperfect. Cable subscription solves the problem of getting the signal to your television, but storms and other factors can result in cable outages. If you prefer not to pay the rising monthly fees for cable or live in an area where it's not available, your picture is likely to be weak, undefined and distorted.

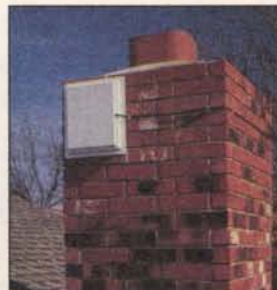
One way to improve your reception would be to mount a large antenna on your roof. Unfortunately, most roof antennas are not particularly pleasing to the eye and may even be prohibited in the area where you live. Rabbit ear antennas don't improve your picture to any great degree and make your room look like something from an earlier decade. Most antennas need to be aimed at the source of the broadcast and require turning mechanisms to pick up the signal clearly.

Whether you live miles out in the country or in a concrete building next door to a broadcast tower, bad reception can rob you of the definition and color you were intended to see. The Optima antenna gives you the signal-grabbing power of a large antenna in an inconspicuous, low-profile size.

Stealth antenna. In the past, creating an antenna with optimal reception meant making it big, with a large amount of surface area. This resulted in products that were large and unsightly or small and ineffective. Either way, the aesthetic look of your room or house suffered. Research and development tended to focus on the television, not on signal reception... until now.

Recently, a brilliant scientist in Colorado developed an antenna that would maximize reception without being overly conspicuous. Emerson, a leader in electronic technology, has now made this innovation available to the public.

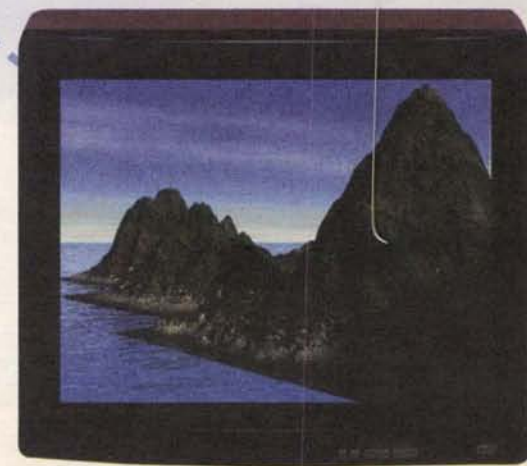
At a lab in Colorado, they developed two patented design improvements that made the Optima antenna possible. First, they created a flexible circuit board with a serpentine antenna, resulting in a large surface area confined to a small space. Second, they developed a technique that converts the copper shielding on the attached cable to an additional signal receiver that results in an antenna almost 10 feet long. This greatly enhances the antenna's reception power and allows you to tune the antenna by simply moving the cable! The antenna



Your neighbors won't know it's there unless you tell them.



Attention mini-dish owners. If you own a mini-dish satellite system, you are aware of the off-air issue and are probably wondering how you can pick up local broadcasts. After all, what good are hundreds of channels if you can't find out who won the local city council race? The Dishmate™ harnesses the same technological innovations as the Optima TV antenna to give you a powerful omnidirectional antenna that is virtually invisible. It is compatible with a variety of systems and is easy to install.



works best at a range of up to 30 miles from the signal source. We recommend an amplifier for reception up to 45 miles away. Ask your representative for details.

The handmade assembly is encased in aircraft-grade plastic and high-density foam. The weather-resistant cover is a neutral white and can be painted to match the color of the house or room. Plus, the omnidirectional design allows you to mount the unit anywhere you please. The Optima's universal design makes it adaptable to any component, and installation is a snap. So sit back, relax and enjoy the clearest picture you can get from your television.

Get the picture...risk-free. Call now to order the small antennas that get big reception. They both come with a 90-day manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. Try them, and if you're not completely satisfied, return them within 90 days for a full "No Questions Asked" refund.

Indoor/Outdoor Antenna \$69.95 \$8 S&H

Dishmate™ UHF/VHF Antenna . . \$69.95 \$8 S&H

The Dishmate™ Antenna will work with 18" dishes from RCA, Toshiba, ProScan, GE, Eurosat, Uniden, Sony and Hughes DSS™ Satellite systems. Please specify when ordering.

Please mention promotional code 3691-13325.

For fastest service, call toll-free 24 hours a day

800-992-2966



To order by mail, send check or money order for the total amount including S&H. To charge it to your credit card, enclose your account number and expiration date.

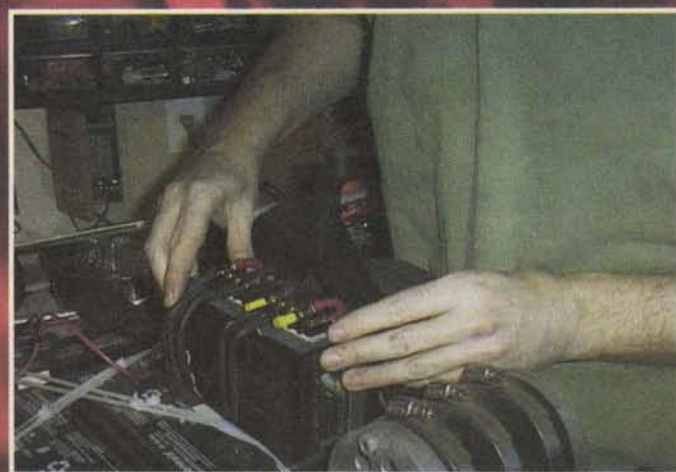
Virginia residents only—please include 4.5% sales tax.

comtrad industries
2820 Waterford Lake Dr., Suite 102
Midlothian, Virginia 23113

"Look at all these people that spent all this money on stuff I get to break," laughs Greg Munson describing his thoughts upon arrival at Robot Wars 1997.

As he and Trey Roski unload their 170-lb. bruiser robot, the other competitors watch in painful anticipation. Behold: the third and latest version of La Machine, a name that chills the hearts of other heavyweight teams. "It's a car accident on wheels," summarizes Roski.

The original version of La Machine made its debut in RW'95 as an 80 lb. middleweight and, when the smoke cleared (literal-



powered steel ram sits menacingly atop the wedge-machine, waiting to whack any unfortunate adversary that climbs high enough on its forward moving edge. It certainly gives a new meaning to the phrase "angle of attack."

Radio-controlled robots for fun and destruction is the goal of

ers of a digital design group even doing at this event? Greg explains, "It's cool to be part of a story that isn't yet written." But the seeds of La Machine were sown long ago in summer projects between the two cousins. "We built prototypes of every idea, ran them into walls, and then investi-

gated what broke." Their motto: test everything.

Robot Wars 1997: La Machine

by Dan Danknick

ly), it had wiped out the heavyweights in the melee round. "If it breaks, I feel we accomplished something," explains Roski and then, in a serious tone, "It's show-and-tell with an emphasis on 'show.'" That original design was \$600.00 worth of wood, aircraft aluminum, batteries, and motors. Eight relays controlled speed and direction. Not exactly the epitome of high-tech, but effective.

This year, it's a \$1,700.00 entry with a custom-welded aluminum shell, high-performance Hawker batteries, and rewind German drive motors. At its peak, it lays out 6HP to the wheels and reaches a sustained speed of 35MPH (during tests on an abandoned aircraft runway.) A CO2-

Robot Wars, an annual smash-fest held in San Francisco. Created and organized by artist Marc Thorpe, it has recently grown in international scope after a special made-for-TV series aired in Great Britain.

In its basic form, entrants fight opponents of like-weight, head-to-head in a protective plastic arena. Sold-out crowds yell and cheer as blows are delivered between the combatants. Allegiance frequently lies with the greater aggressor, but can switch as quickly as the relays running the motors in the arena.

As pioneers of the effective wedge design, Team La Machine has rained its share of destruction upon others. But it has not

emerged unscathed, at times breaking frame and casters, dealing with temperamental weapons, and smoking overheated motors.

"Things we didn't spend much time on are what failed." But this didn't impede La Machine's progress for the spirit of the team. "Our goal has always been to have *nothing* to bring home at the end of the day."

Then what are the co-own-

Even though this can become expensive, they feel it is vital for a robot that is designed to plow into opponents with maximum impact. "I love impact when things are going fast!" chimes in Trey.

Both Trey and Greg can be reached on the Internet at impactmg@slip.net

For more information on the event, you can visit the Robot Wars website at <http://www.robotwars.com/>

A comprehensive analysis of the last two events along with helpful building tips are available on competitor Andrew Lindsey's website at <http://www.cybercomm.net/~alindsey/>

Now in their early 30s, the principals of Team La Machine are no longer the hunters, but the hunted. Losing fights in both '96 and '97 to rival robot Biohazard was certainly not in the plan.

"This year we've built a scale model of Bio to try out some new technology," confides Trey, "we're gonna fight fire with fire." What mysteries that statement holds will certainly be revealed this August at RW'98. But winning or losing, "What is important is having a cool robot." NV



dWIDGETS

For:
Schools
Labs
Robotics
Experimenters

NEW

dIGITAL WIDGETS:

A family of small test and control boards interacting on the I2C bus.

PC or Embedded Micro

I2C BUS

DW01: Parallel Port to I2C Adapter. Master and Slave mode, with Support Software. \$39.

I2C BUS

DW05: LCD Controller, soft config. for std. char mode LCD's. Use as display or config. as I2C bus monitor. \$35.

I2C BUS

DW09: Dual digital Stepper Motor controller, position or velocity ramping, EEPROM config. to your motor. Optoisolated outputs to user's driver electronics. \$49.

AND MORE

Surf to: <http://dwidgets.com>
Or Call: 425-392-6541

VISA/MC P.O. Far Mountain Corp.
Issaquah, WA. 98027

Tiny FBasic Computer



(Shown 85% Actual Size - 40 pin DIP)

The T1Ckit 62 module is like a Parallax Basic Stamp® II, but has 4 times the program space installed (expandable to 64K). It also has 4 times the variable space (96 bytes), and uses a modern structured language similar to BASIC only more powerful.

- Only tool you need is a PC
- Inexpensive \$45/module, \$16/IC
- Development Kit only \$45
- Huge library of I/O function
- Structured FBasic Language
- Easy to learn and use
- Powerful enough for large projects

ASK ABOUT OUR STAMP COMPATIBLE PERIPHERAL COMPONENTS

VersaTech
Electronics

PHONE: (303) 828-9156, FAX: (303) 828-9316
e-mail: versatech@csn.net
Web: www.csn.net/versatech
11170 Flatiron Drive, Lafayette, CO 80026

Basic Stamp is a registered trademark of Parallax, Inc.

Getting Animated With Your Graphics

Plain vanilla graphics just don't cut it anymore for many Web applications, especially for banner ads and other situations where you want to grab a visitor's attention. Think of the Web pages that you visit and the graphics that you remember and click on — most of those are animated, right? And, if you're promoting your Web site through some sort of banner or link exchange, an animated banner is almost a necessity.

There are three main ways you can add animated graphics to your Web site, and it's much more simple to do so than you might think. In fact, no programming is usually needed. This month's column will show you how!

How Animated Graphics Work

Like all moving images, animated graphics are composed of frames. A frame is a complete image that is part of a "stream" of related images. Like a motion picture, each frame is displayed in sequence to create the image of one continuously moving image. Animated Web graphics are

Software Wizardry

By Harry L. Helms

Figure 1

This is frame 1.
This is frame 2.
This is frame 3.

sequences of .GIF (graphics interchange format) images. .GIF is the Web standard for line art (JPEG is the standard for photographic images).

Figure 1 shows a sequence of three frames. Notice that each frame is identical except for the number at the end of the line. When these frames are moved through a sequence, your eye will see what appears to be one image with a number that is constantly changing. The faster the images in the frame are moved through a sequence, the faster the number will appear to change. Each frame in the sequence must occupy the same amount of screen space (such as 250x100 pixels, for example), although the file size for each frame can vary.

The individual .GIFs in your animation can be created with any program that supports the .GIF format, such as Image Composer, PhotoShop, FreeHand, etc.

If you've done much Web surfing at all, you know how slowly some .GIF images download and display in your browser. This points to perhaps the biggest concern of using animated .GIFs on your web site: an animation with several "bulky" frames will take a long time to download and "play." If it takes too long, visitors to your site will probably not wait for it to download and surf elsewhere or stop the download of the graphic.

The keys to keeping your animated graphics "compact" is to use as few individual .GIFs as possible in the animation and to keep the size of the individual .GIFs small. You must carefully

plan your animation to determine how many individual .GIFs you really need. A larger number of individual .GIFs will let you get a "smoother" animation of moving objects (such as a ball that appears to roll across the image). However, you must decide how important "smoothness" and other factors are compared to small file sizes and rapid downloading. You may have to re-think your designs for an animation to eliminate some individual .GIFs.

Individual graphics should be created for minimum file size. The logical starting point is to keep the number of colors used to a minimum; instead of 24-bit color, use just the 216 colors in the standard Web image palette. Develop your animation so that the minimum possible screen area is used by the animations. Try to shave a few pixels in the horizontal and vertical planes; the difference in download time can be surprising.

If you're designing an animated graphic for use as a banner ad or other image that will appear on another Web site, be sure to check on the maximum file size allowed by that Web site. Many sites restrict banner ads and other graphics from outside sources to a total size (all individual .GIF frames and any supporting code) of no more than

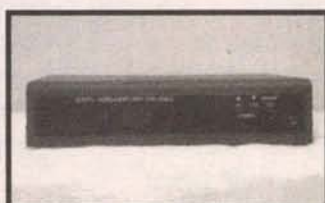
BEST PRICES

ONE STOP SUPPLIER

"One call does it all"

1-888-426-9787

Toll Free



Tri 550 Converter



Millennium Converter



Panasonic Converters

A DOZEN OTHER CONVERTERS AVAILABLE!

Call for Quantity Prices

FILTERS

REMOTES!

Open Monday - Friday 10:00 a.m. - 5:00 p.m. Saturdays 10:00 a.m. - 2:00 p.m.

No Florida Sales • We ship same Day • 90 Day Limited Warranty • Visit us at our website www.onestopcable.com • E-Mail: Info@onestopcable.com

Software Wizardry

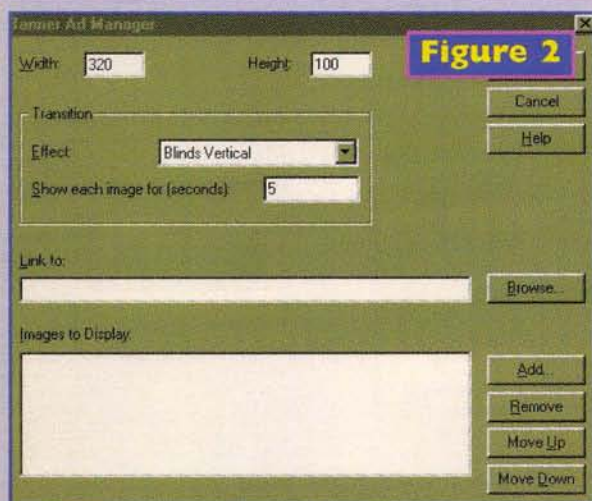


Figure 2

server instead of being downloaded to the user's PC). It's mainly used for processing text and numerical data input sent from a PC to the server, but it can be used for other purposes, like moving the .GIF files in an animation sequence.

Since it is a true programming language, Perl lets you do some very interesting stuff with animated graphics. For example, you can alter the time sequence with which the individual frames are displayed. You can have the images displayed in a random sequence. And you can have the animation displayed in different locations on a Web page.

But using Perl-based animations has some drawbacks. Your Web server must be configured to use Perl, and your animation script must be written to the operating system (Unix, Windows NT, etc.) and Perl interpreter version

used by the server. Since Perl is a programming language, making some changes in your animation sequence will require some understanding of Perl.

As mentioned last month, however, numerous Perl scripts are available free via the Web, including several for animated graphics. Among the places to start looking for them are the Perl language home page (www.perl.com) and Matt's Script Archive (www.scriptarchive.com/scripts).

If you need some really spectacular animated graphics, Perl is probably

the best way to go. But working in Perl will take some knowledge and effort on your part. Unless you're working on a corporate or business site, you'll probably find that using Perl will be more trouble than its worth.

Using Java For Animations

You may have been thinking that Java would be a terrific way to animate graphics. And indeed there are Java-based tools available to create animations.

Microsoft's FrontPage98 includes a Java applet known as the "banner ad manager" that is actually a .GIF animation applet. Figure 2 shows the control and setting window for this applet. The area in pixels occupied by the applet is set at the top of the window, and all .GIF files must be set to this same area. At the bottom of the window is a list of .GIF files in the order in which they will be displayed. .GIF files can be added from a hard drive or floppy, or removed from the list. The .GIFs can also be moved up and down the list. The resulting animation can also be linked to another page in the Web site or to another URL.

Figure 2 shows how Java can create some versatile effects not possible with any other method. This applet lets you choose how you want the transition between .GIF frames handled. The default is to simply switch between frames without a pause, but this applet lets you select options such as horizontal and vertical "blinds" (an effect similar to opening and closing window blinds), as well as "dissolves" from one image to another. You can also select how long you want each .GIF in the sequence to be displayed.

Other Java-based animation cre-

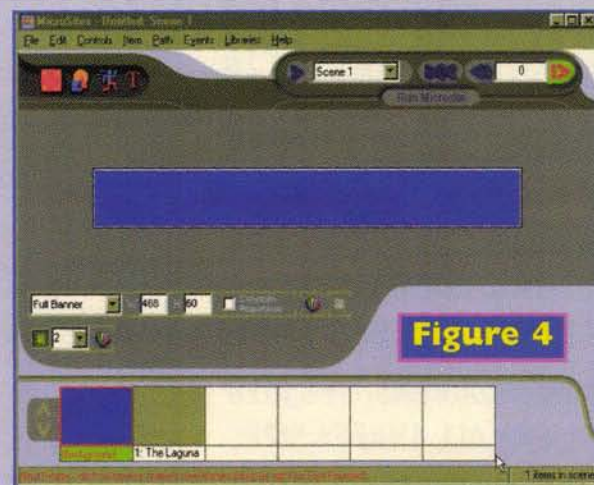


Figure 4

ation tools are available, such as MicroSites from Zapa Digital Arts. This software package is mainly intended for producing animated banner ads, although it can be used for other types of animated graphics. It includes a large amount of clip art, animations, and even sounds that can be added to your frames. Like many software packages today, MicroSites includes a wizard to help you set up the basic design of your animation. Figure 3 shows the template for a frame produced by the wizard; you can add graphics and text as desired to this frame template.

Figure 4 shows the workspace for creating an animation in MicroSites. MicroSites uses the term "scene" for an individual frame in an animation sequence. A scene can include one or more individual .GIF files plus other media elements, such as text and sound files. Scenes can be arranged and re-ordered in an animation sequence, as shown at the bottom of Figure 4.

Using Java — like MicroSites does — allows a high degree of control over how the different frames of an animation sequence are displayed. For example, the timing with which individual .GIF files are shown can be controlled, as can when other scene elements (like sounds) are displayed

9 kilobytes. The "9K" limit is a good rule to follow even if the graphic will only appear on your site, as animations of that size or less download quickly.

Once you've created a series of .GIF frames, then comes the fun part: it's time to animate them!

Animating With Perl

Perl was discussed in last month's column. It's the most widely used server-side programming language (the programs reside on a Web site's

Davilyn
CORP.

13406 Saticoy Street, North Hollywood, CA 91605

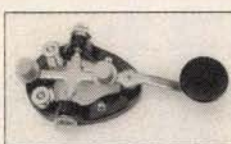
800-235-6222 818-787-3334 • F-818-787-4732 • [HTTP://WWW.Davilyn.com/Electronics](http://WWW.Davilyn.com/Electronics)

CALL FOR FREE CATALOG



TELEGRAPH KEYS

Unique item for military collectors. J37 telegraph key, new in original government package. \$49.95



JONES MODEL 1600-1 TACHOMETER

Instrument tachometer centrifugal mechanical tach measures RPM scale 0-500 RPM, coupling shaft 1/8" accessories, various size rubber tipped drive couplings, case new. Also Jones Model 1600-7 RPM scale 0-11,000 RPM w/accessories new. \$35/ea. or 2 for \$50

MORGAN DATA SYSTEMS MODEL 8609

Constant voltage or current power supply voltage range: 0 to 50 volts. Current range: 0 to 1.5A. Readout: 3 digit with 0.1 volt and 1mA current resolution. Regulation: linear; input voltage: 115V/220V. Adjustments: voltage and current has remote control adjustment capability. NEW. Price: \$195



THE BEST PRICE EVER ON THIS INDUSTRY FAVORITE \$1,095 + SHIPPING

HP 8640B SIGNAL GENERATOR OPT 003



CONDITION CODE "A"

Frequency: 500KHz to 512MHz. Indicates to 1024MHz. Requires external frequency doubler for 1024MHz (supplied with unit). Readout can be used as a frequency counter. Accuracy: 6.5 digits expandable to X10 and X100. Output: -145dBm to +19dBm (0.5 to 512MHz). Modulation: AM, FM, pulse, 400 and 1KHz, 1mV to 1V internal. Has input and output of modulation sources. PRICE: \$1,095

EXCEPTIONAL CONDITION

QUANTITY LTD ORDER TODAY WARRANTY 100 DAYS

HP 200CD Oscillator \$95
HP 331 Distortion Analyzer ... \$249
HP 400E Voltmeter \$325
HP 412A Voltmeter \$95
HP 415E Voltmeter \$125
HP 3435A Multimeter \$295
HP 8160A Generator \$2,800
Tek 2336 Scope \$1,350

Watkins Johnson

WJ-8628-4 Receiver \$8,500

HP 180A SCOPE (MIL SPEC AN/USM-281A)



Includes vertical plug-in 1801A (PL1186), horizontal plug-in 1821A (PL1187). Tested. Manual Reproduction: 15

GREAT PRICE

\$195

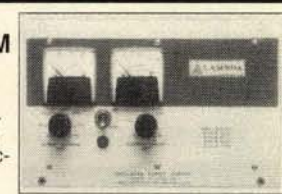


AN/URM-120 50 OHM THRU-LINE RF WATTMETER

Frequency range: 2MHz to 1000MHz. Power range: 10 watts to 1000 watts.

USWR≤1.08 to 1. Uses three plug-in coupler elements (included). CU-753 2 to 30MHz 50 to 100 watts CU-754 25 to 250MHz 10 to 500 watts CU-755 200 to 1000MHz 10 to 500 watts. Connector: Type N. Case included. Size: 7"Wx6-5/8"Hx7-1/5"D. Weight: 6.5 lbs. Price: \$395

LAMBDA LK344A-FM POWER SUPPLY



Front panel voltage and current meters. Convection-cooled, no blower. Voltage adjustable from 0 to 60 VDC at a maximum current of 4A. Regulation 0.015% or 1mV. Line or load. Series/parallel operation. Remotely programmable by voltage or resistance. Less than 500µV RMS ripple. Constant current/constant current. NEW Price: \$395

Write in 27 on Reader Service Card.

ELECTRONIC TOOLS ETC.

TWEEZERS, FORCEPS, SCISSORS

* PROBES (DENTAL PICKS)

* DREMEL TOOLS, ROTARY

TOOL EQUIPMENT

* OPTICAL AIDS (MAGNIFIERS)

* SCREWDRIVERS, TIPS, BITS

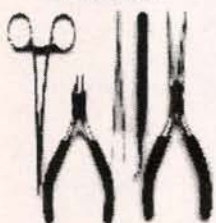
* PLIERS, ALL SHAPES, SIZES

* NEW, HARD TO FIND

TOOLS EVERYDAY

TOLL FREE: 1-888-UTOPIA-2

SAVE
\$
HERE!



UTOPIA
TOOLS

CALL OR WRITE

3699 BARNARD DR.
APT. #519
OCEANSIDE CA
92056

CALL:

(760)439-6682

FAX:

(760)439-6682

CALL NOW FOR FREE CATALOG

Wizardry

or played. You can also give visitors to your Web site control which items are displayed, or the sequence in which they are displayed, through a mouse click on your animated graphic.

Perhaps the most powerful feature of MicroSites is that it allows you to define "animation paths" along which individual .GIF files or text can move across the area of a scene. The motion can be specified to stop at the end of a path, return to the starting position after reaching the end of a path, or to move back and forth along the path in a continuous loop. To get these sort of effects, you need to use a Java-based tool like MicroSites.

But Java-based animations suffer from the same problem as all Java applets: they're slow to download and slow in operation. I've used Java-based animations on my Web sites, and have found that typically the rest of the page, including large .GIF and JPEG files, download before the Java-based animation downloads and start to "run." Much of the impact of the animation is blunted because of this; site visitors see a "hole" in the page where the animation is located until the download is complete.

I think Java-based animations are the wave of the future in Web design, but I also feel that future will wait until Java becomes widely used as a server-side programming language instead of just a client-side interpreted language. My frustration with Java's slowness has led me to remove

all Java applets from my Web site and rely on Perl or JavaScript to provide interactivity. And for animated graphics, I'm now relying on animated .GIFs.

Animated .GIFs

Animated .GIFs were first supported in Netscape 2.0 and were added to Internet Explorer 3.0. Both current versions of the Netscape and Microsoft browsers support animated .GIFs. Animated .GIFs are just a sequence of individual .GIF files displayed in sequence, as described earlier in this column. Because they are simple to create and modify, animated .GIFs are currently my choice for adding animated graphics to a Web site.

Many graphics and Web publishing programs include tools for creating animated .GIFs. Figure 5 shows the .GIF animator included as part of Microsoft's Image Composer graphics package. This tool is similar in features and functions to most other .GIF animators. As you can see in Figure 5, the individual .GIF files in each frame are displayed at the left side of the window. Note that the "Thumbnails Reflect Image Position Box" is checked. This means that the sequence of images at left will be the same sequence in which the images will be shown. Images can be added to the sequence by clicking on the appropriate box at the top of the window.

Figure 6 shows how the parameters of the animation are selected. All individual .GIFs in the sequence must be the same size selected for the animation. The image count changes automatically as new .GIF files are added or cut from the sequence. The check in the box next to "Looping" lets the sequence repeat; if this box is left blank, the sequence will play once and stop at the last frame. The box next to "Repeat Forever" is checked, and this causes the animation sequence to continuously repeat. If it is not checked, the exact number of repetitions can be selected immediately above this box.

You can determine how long each frame in the animation sequence is displayed. In Figure 7, notice the dark box around Frame #1. In this example, Frame #1 will be displayed for 100/100 of a second (that is, one second), although smaller and larger amounts of display time are easy to indicate. The "Undraw" selection

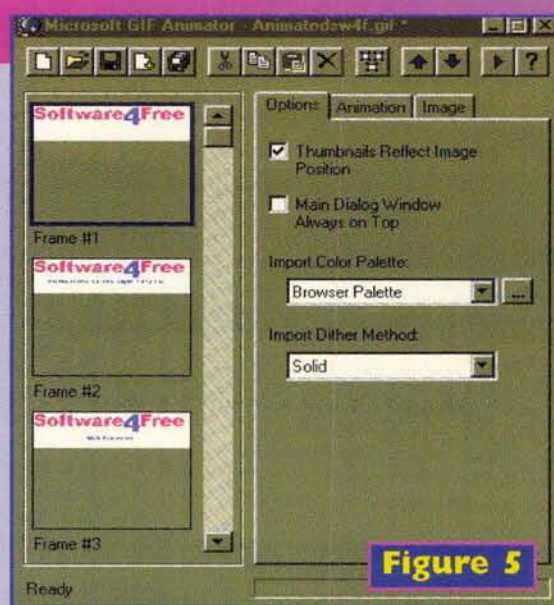


Figure 5

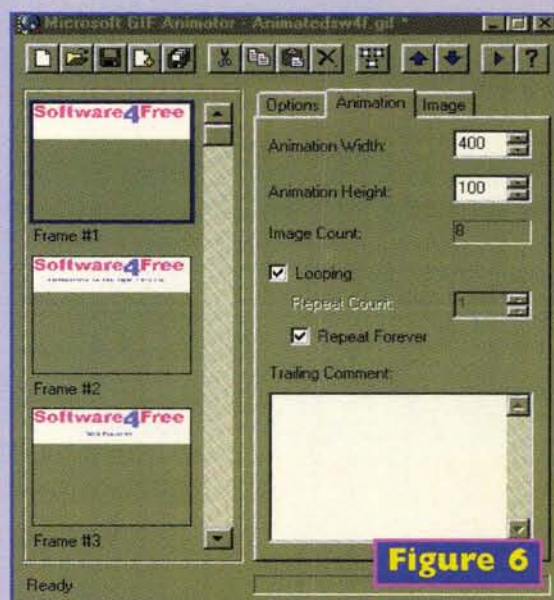


Figure 6

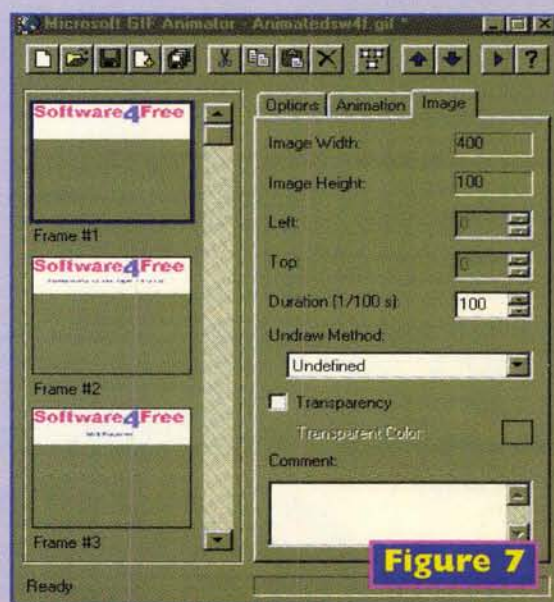


Figure 7

menu lets you decide whether you want a special effect — like briefly restoring the previous image — when leaving that frame in the animation sequence. And you can make the image in the frame transparent by clicking the indicated box.

Developing animated graphics is so easy and so much fun that it's easy to be carried away with them. Like all Web publishing tools, they can get in the way of the message you're trying to convey and actually annoy visitors to your site. Be sure to plan how animations will fit into your total Web design before getting "overly creative!" **NV**

As Simple As Calling A Pager ...

UNDER \$149.95
(WHOLESALE)

With The Auto Remote® ... You have the ability to control any device from anywhere using any touch-tone phone

STANDARD EQUIPMENT FEATURES:

- Wide area data delivery, switching, and control.
- Uses existing paging infrastructure.
- 900 MHz frequencies/synthesized receiver.
- Serial data interface/RS232 option.
- Extended temperature range (-20°C to +70°C).
- Remote antenna options.
- Eight customer configurable open collector outputs.
- Six 350mA current sink or source.
- Two 1.75A current sink or source.
- Serial TTL interface.
- 512, 1200, and 2400 baud POCSAG.

The Auto Remote® 900 MHz Control Module is a fully-programmable, single-board, synthesized message receiver that receives and decodes POCSAG data broadcast over existing paging infrastructure.

Message data is transmitted either out a serial port or used to control eight outputs. The decoded data can output at either TTL or RS232 voltage levels across a half-duplex, serial interface port. The eight outputs provide for activation/deactivation of external loads such as LEDs, relays, contact closures, etc. The eight output ports may be configured as either current sinks or current sources.

The versatility and programmability of the Auto Remote makes it an excellent, easily integrated one-way paging device for use in areas of information management, security control, energy management, auto control, general control, data display, etc.

Dual Frequencies/Multiple Addressing:

The Auto Remote can have two distinct frequencies programmed via the serial interface. Each frequency is capable of supporting four capcode pager addresses. The frequencies can be the same.

Subaddressing (Password):

Each Auto Remote can have two unique password subaddresses to maximize the number of users per address and to allow individual and group call messages.

Gillian Technologies, Inc.

6278 N. Federal Hwy., Suite 178
Ft. Lauderdale, FL 33308
Phone (954) 493-9993
Toll Free (888) 493-9992
Fax (954) 946-0177 • www.autoremove.com

Got Opto? Now is the time to get it!

**Innovative
Products for
a Modern
Planet**

Xplorer

\$799

SAVE
\$100



Receivers

Xplorer Test Receiver:

- 30MHz - 2GHz
- Two line LCD frequency display
- Decode CTCSS, DCS, and DTMF
- 500 memories
- 1000 frequency lockout
- Built-in PC interface
- Capture 5 watt UHF signal from 800 feet

R11

\$299



R11 Test Receiver:

- 30MHz - 2GHz wide band receiver
- Built-in speaker for instant audio demodulation
- LED frequency range indication display
- Reaction Tune with Scout
- Capture 5 watt UHF signal from 500 feet
- 1000 frequency lockout

OS456/535

\$175

SAVE
\$24



PC Control

OS456 / OS535:

Computer control scanning interface board for the popular RadioShack Pro 2005/6 and Pro 2035/42.

Optolinx Universal Interface:

PC interface for downloading frequencies from Scout to a PC, or computer control the ICOM R7000, R7100, R8500, R9000, R10 and also the AOR AR8000. Use built-in data slicer circuit for use with Trunker® software. (Trunker® software not included with Optolinx.)

Optolinx

\$109



SAVE
\$20

Scout

\$349

SAVE
\$100



Counters

Scout Frequency Recorder

- 10MHz - 1.4GHz
- Stores 400 frequencies in memory
- Reaction Tune the ICOM R7000, R7100, R8500, R9000, R10, and AOR 8000
- 10 digit LCD with signal strength bargraph
- Vibrator and beeper alert mode

Cub, M1, 3000APlus:

Handheld frequency counters, all incorporating patented Digital Filter and Digital Auto Capture. All counters come with initial accuracy of +/- 1ppm. High impedance amplifiers standard on M1 and 3000APlus. Call for additional features on all three counters.

Cub
\$149



M1

\$199



3000A+
\$299



SAVE SAVE
\$50 \$50

While on the job or just having fun, take along an Optoelectronics product and experience an entire world of wireless communications.

If you need to calibrate a radio oscillator or just find frequencies around town, you will always be prepared with an Optoelectronics product. Experience the performance of Test Receivers, Frequency Counters, and Computer Control interfaces as so many professional technicians and hobbyist alike have relied upon to get the job done.

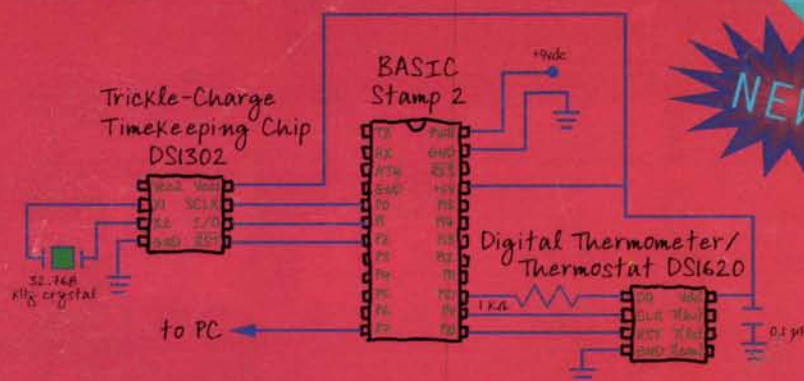
**Factory
Direct Order
Line
800•327•5912**

OPTOELECTRONICS

5821 NE 14th Avenue • Ft. Lauderdale, FL 33334 Telephone • 954•771•2050 Fax • 954•771•2052 EMail • sales@optoelectronics.com
Visa, MasterCard, C.O.D. Prices are subject to change without notice or obligation. No price protection available on sale items.

www.optoelectronics.com

PARALLAX

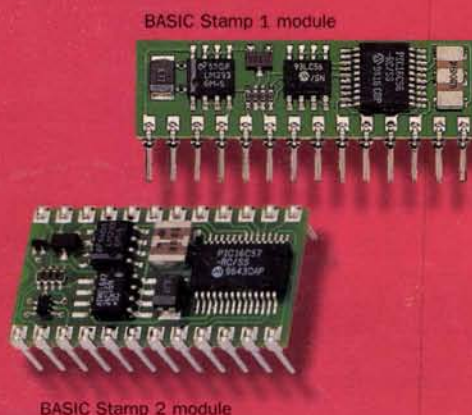


DS1302 Real Time Clock AppKit
(#27921 - \$26)

DS1620 Digital Thermometer / Thermostat
(#27917 - \$26)

NEW!

AppKits include the semiconductor device, source code, technical explanation, and the passive components necessary to interface to the BASIC Stamp I or II. The DS1302 provides an easy solution to add a real-time trickle charge clock to the BASIC Stamp, while the DS1620 measures temperatures between -67° F to +257° F. Use the two AppKits together as shown in the above schematic to collect time-stamped temperature data with your BS2-IC.



Green LEDs (#21-0009 - \$0.75 ea)

Celebrate summer with green LEDs. Use the Stamp's HIGH command and a 470 k Ohm resistor to electrify.

BASIC Stamp 1 module (#BS1-IC - \$34)
BS1-IC Starter Kit (#27205 - \$99)

BASIC Stamp 2 module (#BS2-IC - \$49)
BS2-IC Starter Kit (#27203 - \$149)

BASIC Stamp Rev.D module (not shown #27100 - \$34)
BASIC Stamp Rev.D Starter Kit (#27202 - \$79)

BASIC Stamp Bug (#27922 - \$139)

The new BASIC Stamp Bug is an improvement over his genetically unstable predecessor. The new BASIC Stamp Bug uses the PULSOUT command, HI and LOW to control the servos and LEDs. Requires approximately 1 hour to build. Hardware and source code included (4 AA nicad batteries not included).

NEW!



BASIC Stamp Bug

To order call toll free:
Parallax Inc
888.512.1024

BASIC Stamp and the Parallax logo are registered trademarks of Parallax, Inc

Write in 194 on Reader Service Card.

NUTS & VOLTS MAGAZINE
430 PRINCELAND COURT
CORONA, CA 91719

CHANGE SERVICE REQUESTED

BULK RATE
U.S. POSTAGE
PAID
PERMIT No. 359
LONG BEACH CA

